

JAPANESE [JP,2002-217963,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] It is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold the information on the window size of said 1st terminal unit, A decision means to determine whether perform return processing of said confirmation-of-receipt response based on the information on the window size which said maintenance means holds, Data distribution management equipment characterized by having the control means which performs return processing of said confirmation-of-receipt response when it is determined that said decision means will perform return processing of said confirmation-of-receipt response.

[Claim 2] It is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold the information on the window size of said 1st terminal unit, Data distribution management equipment characterized by having the control means which performs control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows ].

[Claim 3] From the current time delay made into initial value, the predetermined lower limit which carried out abbreviation correspondence to the time delay of the return time which returns a confirmation-of-receipt response to said 1st terminal unit from the reception time of the confirmation-of-receipt response received from said 2nd terminal unit The 2nd subtraction value which subtracted the 2nd value which carried out the multiplication of the predetermined value to the 1st subtraction value which subtracted the last window size from the current window size in said 1st terminal unit, Compute maximum with said predetermined lower limit, and the minimum value of this maximum and a predetermined upper limit is computed. It has further a calculation means to compute the newest current time delay by repeating the processing which resets this minimum value as said current time delay. Said control means Data distribution management equipment according to claim 2 characterized by performing control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the newest current time delay computed by

said calculation means ].

[Claim 4] It is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold at least said window size of the 1st terminal unit, the number of segments of the data received from said 1st terminal unit, and the existence of the confirmation-of-receipt response from said 2nd terminal unit, A decision means to determine whether return said confirmation-of-receipt response to the data which said 1st terminal unit transmitted with the combination of said window size which said maintenance means holds, said number of segments, and the existence of said confirmation-of-receipt response, Data distribution management equipment characterized by having the control means which returns this confirmation-of-receipt response when it is determined that said decision means will return said confirmation-of-receipt response.

[Claim 5] It is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold the information on the window size of said 1st terminal unit, Data distribution management equipment characterized by having the control means which performs control to which it carries out adjustable [ of the creation consistency of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows ].

[Claim 6] The data buffer holding the data which said 1st terminal unit transmitted at least, The management tool which manages the registration information on the data which said 1st terminal unit transmitted at least, When the confirmation-of-receipt response to these data is received from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, Data distribution management equipment of any one publication of claim 1-5 characterized by having further the deletion control means which performs control which deletes the registration information on these data that these data currently held at said data buffer and said management tool manage.

[Claim 7] It has a means further. counting which carries out counting of the number [ finishing / the confirmation of receipt ] of segments which is data for [ of the data held in said data buffer ] deletion -- said deletion control means Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said counting -- this confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds a predetermined number Data distribution management equipment according to claim 6 characterized by deleting the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages.

[Claim 8] the 1st counting which carries out counting of the number [ finishing / the confirmation of receipt ] of segments which is data for [ of the data held in said data buffer ] deletion -- with a means It has a means further. the 2nd counting which carries out counting of the registration information on the data for [ of the data which said management tool manages ] deletion -- said deletion control means Each time of the reception of a confirmation-of-receipt

response to these data from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, The information about these data that said management tool manages is set as confirmation-of-receipt ending. said 1st counting -- the confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds the 1st predetermined number The data [ finishing / this confirmation of receipt ] currently held at said data buffer are deleted. said 2nd counting -- the data distribution management equipment according to claim 6 characterized by deleting the registration information on data [ finishing / this confirmation of receipt ] when the registration information on the data [ finishing / the confirmation of receipt ] in which a means carries out counting exceeds the 2nd predetermined number.

[Claim 9] It has a means further. the time check which clocks predetermined time -- said deletion control means Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said time check -- the data distribution management equipment according to claim 6 characterized by deleting the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages when a means clocks said predetermined time.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. It is related with the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data. It is related with the data distribution management equipment which can improve the rate performance degradation depending on the receiving timing of the confirmation-of-receipt response especially at the time of data distribution.

[0002]

[Description of the Prior Art] From the former, TCP of a transmitting side performs data transmission one after another by the communication link using TCP by having a window size corresponding to a transmission buffer, restricting in this window size, and making a transmit window slide. When it becomes the situation of having not accepted the confirmation-of-receipt response for a certain reason, temporarily, TCP judges that it is in a congestion condition, makes a window size small, by this, tends to lower a throughput and tends to cancel congestion.

[0003] However, while being large capacity like a satellite circuit, when TCP is physically used in the big circuit of a transit delay, 0.5 seconds or more may be taken for the confirmation-of-receipt response to this data to come on the contrary from data transmission with a physical distance. It is time amount until it judges the resending time-out time amount in general TCP, i.e., data transmission, to be failure for these 0.5 seconds and starts data resending, and TCP is the time amount judged that the congestion condition has arisen. Consequently, the trouble that the rate engine performance which balanced the mass magnitude of circuit original like a satellite circuit, i.e., a throughput, cannot be demonstrated arises.

[0004] Drawing 11 is the block diagram showing the configuration of the data distribution managerial system which used conventional data distribution management equipment (Information Processing Society of Japan research report 98-DPS-89 -12 reference). This data distribution managerial system is a system which can solve the trouble mentioned above and can raise a throughput. In drawing 11, this data distribution managerial system has the transmitting gateway 100 connected to a sending set C11, a receiving set C12, and this sending set C11 and receiving set C12 through the circuits L11 and L12 which perform the communication link by TCP, respectively. A circuit L12 is a circuit with a large transit delay as compared with a circuit L11, for example, is a satellite circuit.

[0005] In drawing 11, a sending set C11 has the data packet output section 111 which outputs a data packet, and the temporary confirmation-of-receipt response receive section 112 which receives the temporary attainment Acknowledgement which the transmitting gateway 100 created. While the transmitting gateway 100 has a buffer 101 and the distribution managed table

102 The are recording section 103 which the data packet transmitted from the sending set C11 is received [ section ], and stores up this data packet in a buffer 101, The output section 104 which outputs the data data packet accumulated in the buffer 101 through the circuit L12 to a receiving set C12, The temporary confirmation-of-receipt response creation section 105 which creates the temporary confirmation-of-receipt response to the data packet which transmitted to the receiving set C12, The temporary confirmation-of-receipt response transmitting section 106 which transmits this created temporary confirmation-of-receipt response to a sending set C11, With the temporary confirmation-of-receipt response receive section 107 which receives the confirmation-of-receipt response sent from the receiving set C12 Communication link information is acquired from the SYN (connection request) packet which received, and it has the delivery information storage control section 108 recorded on the distribution managed table 102 as delivery information, and the resending-processing-section 109 which performs resending processing of a data packet. Moreover, a receiving set C12 has the data packet receive section 121 which receives the data packet sent from the transmitting gateway 100, and the confirmation-of-receipt responded-output section 122 which outputs a confirmation-of-receipt response to the transmitting gateway 100.

[0006] If a data packet is sent out from a sending set C11, the transmitting gateway 100 will add the entry of this data packet to the distribution managed table 102 while accumulating the data packet which received in a buffer 101 temporarily. The transmitting gateway 100 creates the data packet of a temporary attainment Acknowledgement to this data packet, and transmits this temporary attainment Acknowledgement to a sending set C11 while it transmits the data packet which received from the sending set C11 to a receiving set C12 through a circuit L12.

[0007] If a data packet is received from the transmitting gateway 100, a receiving set C12 will create the confirmation-of-receipt response to this receiving data packet, and will transmit this confirmation-of-receipt response to the transmitting gateway 100. The data about a corresponding data packet and the data about the attainment check situation of this data packet are contained in this confirmation-of-receipt response. The transmitting gateway 100 which received the confirmation-of-receipt response from the receiving set C12 is a data packet currently held in the transmitting gateway 100, and clears the data packet corresponding to this confirmation-of-receipt response.

[0008] Here, in the process in which a data packet is transmitted to a receiving set C12 from the transmitting gateway 100, when a transfer of this data packet goes wrong and a receiving set C12 is not able to receive this data packet, from a receiving set C12 side, three same confirmation-of-receipt responses are continued, it receives, and the transmitting gateway 100 performs resending processing of this data packet.

[0009] Thus, in the conventional data distribution managerial system, by returning a temporary confirmation-of-receipt response (tmpACK) to the transmission and coincidence of a data packet to a receiving set C12 from the transmitting gateway 100 to a sending set C11, the transmitting gateway 100 prevented reduction of the window size of TCP by \*\*\*\*\* of a circuit L12, lost the fall of a throughput, and has improved degradation of the rate engine performance.

[0010] Moreover, when the transmitting gateway 100 will hold this data packet and will receive three same confirmation-of-receipt responses (DuplicateACK) until it creates a temporary confirmation-of-receipt response and receives the confirmation-of-receipt response (ACK) from a receiving set if a data packet is received from a sending set, it judges transmission of this data packet to be failure, and is made to resend this data packet currently held.

[0011]

[Problem(s) to be Solved by the Invention] however, in the conventional data distribution managerial system When a data segment is received from a sending set C11, the transmitting gateway 100 The transceiver buffer of a sending set C11 or the condition of a window, the \*\* that does not take into consideration the congestion condition of a circuit L11 further, Since the temporary confirmation-of-receipt response to all data segments is created immediately and he was trying to transmit to a sending set C11, the processing load of the transmitting gateway 100 and a sending set C11 became large, and there was a trouble that the case where the rate engine performance deteriorates as a result arose.

[0012] Moreover, although transmitted by the throughput determined according to the condition of the receiving window of the sending set C11 which the receiving set C12 grasps, data including the confirmation-of-receipt response transmitted from the receiving set C12. When data are received in the transmitting gateway 100. Since data transfer was performed by the throughput based on the last old window size, When the receive buffers or receiving windows of a sending set C11 are decreasing in number, It could not respond to the condition of the receive buffer or receiving window where the sending set C11 was updated, but there was a trouble that the receive buffer and window of a sending set C11 may cause overflow.

[0013] This invention was made in view of the above, adjusts the transmit timing or the amount of transmission of a temporary confirmation-of-receipt response in consideration of conditions, such as congestion of a transceiver buffer, a window size, and a circuit, and aims at obtaining further a high speed and the data distribution management equipment which can perform data distribution efficiently.

[0014]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the data distribution management equipment concerning this invention It is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold the information on the window size of said 1st terminal unit, A decision means to determine whether perform return processing of said confirmation-of-receipt response based on the information on the window size which said maintenance means holds, When it is determined that said decision means will perform return processing of said confirmation-of-receipt response, it is characterized by having the control means which performs return processing of said confirmation-of-receipt response.

[0015] According to this invention, a maintenance means holds the information on the window size of said 1st terminal unit. It is determined whether a decision means performs return processing of said confirmation-of-receipt response based on the information on the window size which said maintenance means holds. Only when a control means determines that said decision means will perform return processing of said confirmation-of-receipt response, it is made to perform return processing of said confirmation-of-receipt response, and he is trying to adjust the transmit timing or the amount of transmission of a confirmation-of-receipt response to a transmitting agency.

[0016] The data distribution management equipment concerning the next invention is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold the information on the window size of said 1st terminal unit, It is characterized by having the control means which performs control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows ].

[0017] According to this invention, a maintenance means holds the information on the window size of said 1st terminal unit, and the control means is made to perform control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on

the window size which said maintenance means holds shows ].

[0018] The data distribution management equipment concerning the next invention the predetermined lower limit which carried out abbreviation correspondence from the current time delay made into initial value to the time delay of the return time which returns a confirmation-of-receipt response to said 1st terminal unit in the above-mentioned invention from the reception time of the confirmation-of-receipt response received from said 2nd terminal unit The 2nd subtraction value which subtracted the 2nd value which carried out the multiplication of the predetermined value to the 1st subtraction value which subtracted the last window size from the current window size in said 1st terminal unit, Compute maximum with said predetermined lower limit, and the minimum value of this maximum and a predetermined upper limit is computed. It has further a calculation means to compute the newest current time delay by repeating the processing which resets this minimum value as said current time delay. Said control means It is characterized by performing control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the newest current time delay computed by said calculation means ].

[0019] According to this invention, a calculation means the predetermined lower limit which carried out abbreviation correspondence from the current time delay made into initial value to the time delay of the return time which returns a confirmation-of-receipt response to said 1st terminal unit from the reception time of the confirmation-of-receipt response received from said 2nd terminal unit The 2nd subtraction value which subtracted the 2nd value which carried out the multiplication of the predetermined value to the 1st subtraction value which subtracted the last window size from the current window size in said 1st terminal unit, Compute maximum with said predetermined lower limit, and the minimum value of this maximum and a predetermined upper limit is computed. The newest current time delay is computed by repeating the processing which resets this minimum value as said current time delay. It is made to perform control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the newest current time delay by which said control means was computed with said calculation means ].

[0020] The data distribution management equipment concerning the next invention is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold at least said window size of the 1st terminal unit, the number of segments of the data received from said 1st terminal unit, and the existence of the confirmation-of-receipt response from said 2nd terminal unit, A decision means to determine whether return said confirmation-of-receipt response to the data which said 1st terminal unit transmitted with the combination of said window size which said maintenance means holds, said number of segments, and the existence of said confirmation-of-receipt response, When it is determined that said decision means will return said confirmation-of-receipt response, it is characterized by having the control means which returns this confirmation-of-receipt response.

[0021] According to this invention, a maintenance means holds at least said window size of the 1st terminal unit, the number of segments of the data received from said 1st terminal unit, and the existence of the confirmation-of-receipt response from said 2nd terminal unit. It is determined whether a decision means returns said confirmation-of-receipt response to the data which said 1st terminal unit transmitted with the combination of said window size which said maintenance means holds, said number of segments, and the existence of said confirmation-of-receipt response. A control means When it is determined that said decision means will return said confirmation-of-receipt response, it is made to return this confirmation-of-receipt response.



[0022] The data distribution management equipment concerning the next invention is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold the information on the window size of said 1st terminal unit. It is characterized by having the control means which performs control to which it carries out adjustable [ of the creation consistency of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows ].

[0023] According to this invention, a maintenance means holds the information on the window size of said 1st terminal unit, and it is made to perform control whose control means thins out adjustable, for example, a confirmation-of-receipt response, for the creation consistency of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows.

[0024] The data buffer to which the data distribution management equipment concerning the next invention holds the data which said 1st terminal unit transmitted at least in the above-mentioned invention, The management tool which manages the registration information on the data which said 1st terminal unit transmitted at least, When the confirmation-of-receipt response to these data is received from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, It is characterized by having further the deletion control means which performs control which deletes the registration information on these data that these data currently held at said data buffer and said management tool manage.

[0025] According to this invention, a data buffer holds the data which said 1st terminal unit transmitted at least. A management tool manages the registration information on the data which said 1st terminal unit transmitted at least. When the confirmation-of-receipt response to these data is received from said 2nd terminal unit with which the deletion control means transmitted the data which said 1st terminal unit transmitted, It is made to perform control which deletes the registration information on these data that these data currently held at said data buffer and said management tool manage.

[0026] It has a means further. counting to which the data distribution management equipment concerning the next invention carries out counting of the number [ finishing / the confirmation of receipt ] of segments which is data for [ of the data held in said data buffer ] deletion in the above-mentioned invention -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit which transmitted the data with which said 1st terminal unit transmitted said deletion control means, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said counting -- this confirmation of receipt in which a means carries out counting -- finishing -- when the set-up number of segments exceeds a predetermined number, it is characterized by deleting the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages.

[0027] Counting of the number [ finishing / the confirmation of receipt ] of segments whose means is data for [ of the data held in said data buffer ] deletion is carried out. according to this invention -- counting -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said counting -- this confirmation of receipt in which a means carries out counting -- finishing -- when the set-up number of segments exceeds a predetermined number, he is trying to delete the registration

information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages [0028] the 1st counting to which the data distribution management equipment concerning the next invention carries out counting of the number [ finishing / the confirmation of receipt ] of segments which is data for [ of the data held in said data buffer ] deletion in the above-mentioned invention -- with a means It has a means further. the 2nd counting which carries out counting of the registration information on the data for [ of the data which said management tool manages ] deletion -- said deletion control means Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, The information about these data that said management tool manages is set as confirmation-of-receipt ending. said 1st counting -- the confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds the 1st predetermined number the data [ finishing / this confirmation of receipt ] currently held at said data buffer -- deleting -- said 2nd counting -- when the registration information on the data [ finishing / the confirmation of receipt ] in which a means carries out counting exceeds the 2nd predetermined number, it is characterized by deleting the registration information on data [ finishing / this confirmation of receipt ].

[0029] Counting of the number [ finishing / the confirmation of receipt ] of segments whose means is data for [ of the data held in said data buffer ] deletion is carried out. according to this invention -- the 1st counting -- A means carries out counting of the registration information on the data for [ of the data which said management tool manages ] deletion. the 2nd counting -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, The information about these data that said management tool manages is set as confirmation-of-receipt ending. said 1st counting -- the confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds the 1st predetermined number the data [ finishing / this confirmation of receipt ] currently held at said data buffer -- deleting -- said 2nd counting -- when the registration information on the data [ finishing / the confirmation of receipt ] in which a means carries out counting exceeds the 2nd predetermined number, he is trying to delete the registration information on data [ finishing / this confirmation of receipt ]

[0030] It has a means further. the time check whose data distribution management equipment concerning the next invention clocks predetermined time in the above-mentioned invention -- said deletion control means Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said time check -- when a means clocks said predetermined time, it is characterized by deleting the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages.

[0031] It has a means further. according to this invention -- a time check -- the time check whose means clocks predetermined time -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, these data that said management tool manages -- registration information -- the confirmation of receipt -- finishing -- setting up -- a time check -- when a means clocks said predetermined time, he is trying to delete the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages

[0032]

[Embodiment of the Invention] Hereafter, with reference to an accompanying drawing, the gestalt of suitable operation of the data distribution management equipment concerning this invention is explained to a detail.

[0033] Gestalt 1. drawing 1 of operation is the block diagram showing the configuration of the

data distribution managerial system containing the data distribution management equipment which is the gestalt 1 of implementation of this invention. In drawing 1 , a terminal unit C1 is connected to data distribution management equipment 10 through circuit 2a, data distribution management equipment 10 is connected to data distribution management equipment 20 through a circuit 3, and, as for this data distribution managerial system, data distribution management equipment 20 is connected to a terminal unit C2 through circuit 2b. A circuit 3 is a big circuit of transit delays, such as a satellite circuit, and circuit 2a and 2b are circuits with a small transit delay as compared with a circuit 3.

[0034] Data distribution management equipment 10 has gateway function part 10a, the distribution managed table 1, the protocol managed table 5, and a transmission buffer 6 and a receive buffer 7. With the communications department 17 where Gateway SG performs radial transfer of a data packet between terminal-units C1-With the communications department 11 which performs radial transfer of a data packet between the terminal units C2 through data distribution management equipment 20 The tmpACK buffer 4 which saves the data packet for creating a temporary confirmation-of-receipt response (tmpACK), The tmpACK use judging section 12 which judges whether tmpACK is returned to the data packet which transmitted to the terminal unit C2, and the tmpACK creation section 13 which creates tmpACK based on the data packet which received from the terminal unit C1, The SGTimer count area 14 which the time-out time amount (SGTimer) of the confirmation-of-receipt response for every data packet is counted [ count area ] up, and generates the time-out event of the waiting for this confirmation-of-receipt response, The distribution data-logging section 15 which performs processing which writes the information on whether tmpACK was transmitted to the terminal unit C1, and the information about the confirmation-of-receipt response from a terminal unit C2 in the distribution managed table 1, It has SG distribution Management Department 16 which manages distribution of a data packet corresponding to the contents of a SGTimer value and the distribution managed table 1.

[0035] In addition, in drawing 1 , although the transmission buffer 6, the receive buffer 7, and the tmpACK buffer 4 are shown as a respectively separate buffer, they may be made to mount not only this but partial or all as the same buffer. Moreover, even if it is the case where it mounts as the same buffer even if it is the case where it mounts as a separate buffer, the increase in efficiency of management and retrieval can be attained by preparing the managed table which can be used with the information which includes control information etc. according to the management purpose and which is not illustrated, and mounting so that the storing location of packet data may be identifiable.

[0036] Data distribution management equipment 20 has the same configuration as data distribution management equipment 10. Data distribution management equipment 10 transmits the data packet transmitted from the terminal unit C1 to a terminal unit C2 through data distribution management equipment 20. Under the present circumstances, data distribution management equipment 10 receives the data packet which received from the terminal unit C1 in the tmpACK use judging section 12. When judged with judging and applying whether the return function of tmpACK is applied, The temporary attainment Acknowledgement (tmpACK) to the data packet transmitted to the terminal unit C1 is returned. Data distribution management equipment 20 Only routing processing which transmits the data packet sent from data distribution management equipment 10 to a terminal unit C2 like the usual gateway is performed, and return processing of tmpACK is not performed. Moreover, data distribution management equipment 20 transmits the data packet transmitted from the terminal unit C2 to a terminal unit C1 through data distribution management equipment 10. Under the present circumstances, data distribution management equipment 20 receives the data packet which received from the terminal unit C2 in the tmpACK use judging section 12. When judged with judging and applying whether the return function of tmpACK is applied, tmpACK to the data packet transmitted to the terminal unit C2 is returned. Data distribution management equipment 10 Only routing processing which transmits the data packet sent from data distribution management equipment 20 to a terminal unit C1 like the usual gateway is performed, and return processing of tmpACK is not performed. Two-way communication between terminal units C [ C1 and ] 2 is realized by this. In

addition, although a terminal unit C1 considers as a transmitting-side terminal, a terminal unit C2 considers as a receiving-side terminal and processing of data distribution management equipment 10 of operation is explained by the following explanation, processing of data distribution management equipment 20 when a terminal unit C2 considers as a transmitting-side terminal and a terminal unit C1 carries out a receiving-side terminal of operation is the same as data distribution management equipment 10.

[0037] Here, with reference to drawing 2 - drawing 8, data distribution management processing of data distribution management equipment 10 is explained. First, if the communications departments 17 and 11 of Gateway SG receive a data packet, this data packet that received is saved at a receive buffer 7 temporarily, and SG distribution Management Department 16 performs message distribution processing shown in drawing 2.

[0038] In drawing 2, the tmpACK use judging section 12 checks the data packet which received first, it opts for "ON" of a tmpACK available flag to the receiving data packet which data distribution management equipment 10 has according to this check result, and "OFF", and the information on a receiving data packet including "ON" of a tmpACK available flag, and "OFF" is registered into the distribution managed table 1 if needed (step S11).

[0039] Then, it judges whether use control of tmpACK is performed based on a tmpACK control flag (step S12). In not performing use control of tmpACK (steps S12 and NO), it ends this processing as it is, and in performing use control of tmpACK (steps S12 and YES), tmpACK use control processing is performed (step S13), and it ends this processing.

[0040] Drawing 3 is a flow chart which shows the check procedure of the packet in step S11 shown in drawing 2. In drawing 3, data distribution management equipment 10 first judges whether the IP address of the data packet which received is a right IP address, and it is the transfer the transmission place of the data packet which received minded the big circuit of delay using path managed table 1a (step S21). At this step S21, it checks whether the header of a network layer is an IP header, and judges whether a transit delay circuit exists after that on the path determined by the routing function using the distribution managed table 1. When the protocol does not use IP, it is not the address of a right format and a transit delay circuit does not exist on the path to the destination further (steps S21 and NO), a tmpACK available flag is set as "OFF" (step S22), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11. In addition, when using the managed table which is prepared in the separate buffer or the same buffer mentioned above and which is not illustrated, you may make it hold this tmpACK available flag as information in this managed table.

[0041] Here, drawing 4 is drawing showing the contents of path managed table 1a. In drawing 4, for every destination IP, the path to the destination is managed by this path managed table 1a, and existence is described for delay for every path. For example, although four paths of path "1" - "4" are listed when Destination IP is "10.74.3.200", the path of a path "1" turns into a path with delay. Therefore, when a path "1" is chosen, it is judged that it is the transfer to the circuit of delay dependence.

[0042] Then, when the IP address of the data packet which received is right and a transit delay exists in the path to the destination (steps S21 and YES), the tmpACK use judging section 12 judges whether the protocol of IP header is delay dependence using the protocol managed table 5 (step S24). When the protocol of IP header is delay dependence (steps S24 and YES), it judges whether the transmit port of a TCP header is delay dependence further (step S25). When the protocol of IP header is not delay dependence (steps S24 and NO), and when the transmit port of a TCP header is not delay dependence (steps S25 and NO), a tmpACK available flag is set as "OFF" (step S22), the data packet which received further is transmitted to the destination (step S23), and a return is carried out to step S11.

[0043] Here, drawing 5 is drawing showing an example of the judgment table in the protocol managed table 5 which the tmpACK use judging section 12 uses. In drawing 5, the item D1 of a reference header shows the header unit used for the judgment of the data packet for a judgment. Moreover, the item D2 of a protocol name shows the classification item of the protocol of the data in the header unit specified by the item D1 of a reference header. Furthermore, the information which shows whether the item D3 of spoofing use propriety is the

protocol which should use return processing of tmpACK is expressed. If concrete decision processing of steps S24 and S25 based on this judgment table is explained, it will set to step S24 first. The tmpACK use judging section 12 When judged with having received the data of TCP with reference to the sequence of bytes which shows the protocol of received IP header of a data packet, it sets to step S25. When judged with it not being BGP with reference to the transmitting agency port number of a TCP header unit, it can be judged that return processing of tmpACK can be used. On the other hand, when the data of BGP are received, it can be judged that return processing of tmpACK cannot be used.

[0044] Moreover, in step S24, when the higher-level protocol in the protocol section of IP header is not a protocol of delay dependence in data distribution management equipment 10 (steps S24 and NO), as mentioned above, a tmpACK available flag "is cleared" (step S22), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11. On the other hand in step S24, a higher-level protocol is judged to be the protocol of delay dependence, in step S25 also when it is not the protocol of the delay dependence based on the transmitting agency port number of a TCP header, as mentioned above, a tmpACK available flag "is cleared" (step S22), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11.

[0045] Now, in steps S24 and S25, when it is judged that it is the protocol of delay dependence, with reference to the value of the code bit of the header unit of the data packet which received, it judges whether it is a data packet at the time of communication link initiation (step S26). The buffer of dedication is formed as a packet buffer at the time of the initiation which is not illustrated. Or it is good also as a packet buffer at the time of the initiation which is not illustrated using buffers, such as a receive buffer 7 and a transmission buffer 6. In addition, a tag is attached for every class of every communication link at the time of defining what has the same equipment and the same communication link port which communicate as one communication link, and communication link, and you may make it manage the whole combination of the sending set which communicates the data packet saved at a packet buffer at the time of the initiation which is not illustrated every sending set and the whole receiving set, and a receiving set.

[0046] In not being a data packet at the time of communication link initiation (steps S26 and NO), the data packet which received judges whether it is a registered communication link already on the distribution managed table 1 (step S27). At this step S27, all of combination with the transmitting agency port the transmitting agency IP of an in [ IP header ] and in a TCP header and the combination of Destination IP and a destination port make the same communication link the same management unit, and it is judged that it is a registered communication link.

[0047] Here, drawing 6 is drawing showing an example of a distribution managed table. In drawing 6, items D11-D 16 are items showing the information about the communication link with the same management unit, and items D17-D 19 are items showing the information about the data packet which data distribution management equipment 10 received in the communication link with the same management unit. Each items D11-D 19 are the information acquired from the data packet which data distribution management equipment 10 received. An item D13 expresses a transmitting agency port number, an item D14 expresses a destination port number, an item D11 expresses the transmitting agency IP address of the communication link to manage, and the item D16 expresses [ an item D12 expresses a destination IP address, and / an item D15 shows a temporary ACK halt flag and ] each newest transmitting window size and newest receiving window size in a transmitting agency and the destination. Moreover, an item D17 expresses the sequence number of the data segment which data distribution management equipment 10 received in this communication link, and the item D18 expresses the information about transmission of tmpACK. The information on whether the information and tmpACK of whether to be the data packet which can transmit were transmitted including the case of conditioning when certain conditions are ready to a transmitting agency etc. is used for the information on this item D18 as a value. moreover, finishing [ an item D19 / the data packet which expresses the information over the confirmation-of-receipt response (RRACK) from the destination, and corresponds in drawing 6 / reception of RRACK ] -- it is -- it has two values of the "ACK

waiting" showing being in the condition of waiting for the attainment showing things of "finishing [ ACK reception ]" and RRACK.

[0048] In drawing 6 in a line DD 1 for example, from the transmit port "FTP.DATA" of the terminal unit "10.74.3.177" of a transmitting agency In the communication link to the destination port "1301" of the terminal unit "10.74.3.200" of the destination A temporary ACK halt flag is "OFF". The transmitting window size and receiving window size of a transmitting agency, And the data packet which all of the transmitting window size and receiving window size of the destination are 16 K bytes, and has a sequence number "398" Even when transmission of tmpACK becomes that is, improper [ "improper" ] and what kind of conditions, it is the data packet which does not transmit tmpACK and expresses that it is in the condition of waiting for the confirmation-of-receipt response from the destination at present.

[0049] SG-distribution Management-Department 16 can perform management-of the transmission buffer 6 of control of the transmitting rate of RRACK which is the confirmation-of-receipt response from tmpACK and the destination to control [ of resending according to the management, the confirmation of receipt, and the receiving result of tmpACK of a data packet ], and transmitting origin, control of the transfer rate to the destination, and data distribution management equipment 10, and a receive buffer 7 using the item added if needed [ the item and if needed ] this distribution managed table 1 mentioned above.

[0050] It judges whether data distribution management equipment 10 has the communication link expressed with combination with the transmitting agency port the transmitting agency IP of an in [ IP header ], and in a TCP header, and the combination of Destination IP and a destination port in the distribution managed table 1 with reference to the transmitting agency port number and the destination port number in the transmitting agency IP address in received IP header of a data packet, a destination IP address, and a TCP header using this distribution managed table 1. When it is the communication link which is not registered into the distribution managed table 1 as a result of this decision (steps S27 and NO), it will shift to step S22.

[0051] Moreover, when it is judged that it is the communication link registered into the distribution managed table 1 (steps S27 and YES), Shift to step S31 and the data packet which received judges whether it is a data packet in the receiving window of the destination. When it is a data packet in the receiving window of the destination (steps S31 and YES), When it shifted to step S32 and is not a data packet in the receiving window of the destination (steps S31 and NO), A tmpACK available flag "is cleared". On the distribution managed table 1 The information about a data packet is registered, a tmpACK available flag is set as "OFF" (step S39), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11.

[0052] On the other hand, when it is judged in step S32 that it is not the data packet of communication link termination, it shifts to step S34. The distribution managed table 1 is referred to in step S34. The Window size of a convention of the "transmitting Window size" of a transmitting agency, For example, the Window size of a convention of the "receiving Window size" of whether it has reached more than "2" and the destination, For example, when it judged whether it would have reached more than "2" and it is judged that both sides have reached regular Window size (steps S34 and YES), The tmpACK available flag of data distribution management equipment 10 is set as "OFF" (step S39), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11. Moreover, in step S32, when it is judged that it is the data packet of communication link termination (steps S32 and YES), it shifts to step S40. At step S40, improper [ "improper" ] and "finishing [ FIN flag reception ]" are put into the item D18 about tmpACK transmission of the distribution managed table shown in drawing 6, and it shifts to it at step S23.

[0053] On the other hand, when Window size is judged not to be enough in step S34, it judges whether the data packet which received is the confirmation-of-receipt response from a terminal unit C2 (step S35). When it is judged that the data packet which received is not the confirmation-of-receipt response from a terminal unit C2 (steps S35 and NO), information is registered into the distribution managed table 1, a tmpACK available flag is set as "ON" (step S37), the data packet which received is transmitted to the destination (step S23), and a return is

carried out to step S11. In addition, the data packet "set" the tmpACK available flag is saved at a transmission buffer 6. In case step S37 is processed, depending on mounting, the information on whether use of tmpACK is possible is set up as information in the arrival time point of the newest data packet for every entry of the information about each data packet of the distribution managed table 1. This can perform fine control according to the condition of the window size of not performing tmpACK use control for example, at the time of a slow start.

[0054] When it is judged that the data packet which received is the confirmation-of-receipt response from a terminal unit C2 (steps S35 and YES), At the tmpACK buffer 4, save the data packet which received, and it is received at SG distribution Management Department 16 of data distribution management equipment 10. The event which notifies having received the confirmation-of-receipt response from the terminal unit C2 is generated, a tmpACK available flag is set as "ON" (step S36), and a return is carried out to step S11. In addition, processing of this step S36 can also save only the required parts of for example, IP header, IP data division, etc. by mounting. Moreover, the data packet which received judges whether it is a data packet after what was already registered as a data packet for tmpACK creation, and you may make it register the data packet of the newest, i.e., the very back, as a data packet for tmpACK creation by a sequence number etc. Moreover, in step S35, also when the data packet which received is not the confirmation-of-receipt response from a terminal unit C2 (steps S35 and NO), it is also possible to save the data packet which received at the tmpACK buffer 4, and to use the data for tmpACK creation time as an object for tmpACK creation.

[0055] On the other hand, when it is judged in step S26 that it is the data packet of communication link initiation, it judges whether it is correctly transmitted and received as the procedure of a communication link of the data packet of communication link initiation including the data packet which is making a current judgment (step S29). According to a series of activities, the data packet of communication link initiation is saved at a packet buffer at the time of the initiation which does not illustrate only the thing which had it checked to have reached in order of the right. Therefore, what is necessary will be just to check either of whether decision of this step S29 is the data packet which should be received by the degree of the data packet for the time of the communication link initiation received by the last in whether the data packet which received is a data packet for the time of the first communication link initiation, and the same communication link.

[0056] Then, when data distribution management equipment 10 is judged to have received the data packet of communication link initiation in right sequence (steps S29 and YES), additional registration of the information on this data packet is carried out at the distribution managed table 1 (step S30). Then, when it judges whether the data packet which received is the confirmation-of-receipt response from a terminal unit C2 (step S41) and it is judged that it is the confirmation-of-receipt response from a terminal unit C2 (steps S41 and YES), after processing step S36 mentioned above, a return is carried out to step S11. On the other hand, when it is judged that it is not the confirmation-of-receipt response from a terminal unit C2 (steps S41 and NO), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11.

[0057] On the other hand, it sets to step S29. When it is judged that it is not the communication link registered into the distribution managed table 1 in step S27 when data distribution management equipment 10 is judged to have not received the data packet of communication link initiation in right sequence (steps S29 and NO) (steps S27 and NO), The tmpACK available flag of data distribution management equipment 10 "is cleared" (step S22), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11.

[0058] Below, with reference to the flow chart shown in drawing 7, the detailed level procedure of the tmpACK use control processing by step S13 shown in drawing 2 is explained. Drawing 7 is a flow chart which shows the adjustment procedure of the transmit timing of tmpACK according to a window size. Here, a data segment is received and this adjustment processing is started with reference to a tmpACK use control flag by a tmpACK use control implementation event or the event outputted from the timer in connection with delay temporary ACK, or a counter. After delay temporary ACK waits for reception of fixed time amount or the number of fixed packets, it



is creating and transmitting temporary ACK (tmpACK), and aims being the same as that of the technique of the delay ACK in TCP etc. at urging processing of data distribution management equipment 10 and reduction of the flows between data distribution management equipment 10. [0059] With therefore, the event which the timer in connection with delay temporary ACK and a counter output In for example, the case of mounting using delay temporary ACK by the approach of performing creation and transmission of delay temporary ACK after waiting fixed time The timer with which the tmpACK use judging section 12 measures the timing which generates delay temporary ACK, It has the delay temporary ACK time amount progress flag with which the value of ON and OFF is set up by a time-out time amount variable or a constant, and them, and it generates in order to tell that the latency time for delay temporary ACK came to the tmpACK creation section 13 for every fixed time amount.

[0060] In drawing 7, it judges whether the data packet of communication link termination is receiving settled with reference to the value of the flag set up by a series of processings first shown in drawing 3 received [ FIN ] (step S51). When finishing [ FIN packet reception ] is judged (steps S51 and YES), a return is carried out to step S13 as it is. On the other hand, when finishing [ FIN packet reception ] is not judged (steps S51 and NO), it judges whether the data packets saved at the tmpACK buffer 4 are an SYN data packet and an ACK data packet (SYN+ACK) (packet) (step S52). (SYN+ACK) When it is a packet (steps S52 and YES), it transmits to the transmitting [ a non-transmitted packet (SYN+ACK) ] origin C1, i.e., a terminal unit, (step S53), and a return is carried out to step S13. a \*\*\*\*\* [ having, received the data segment required for transmission of tmpACK on the other hand, with reference to "ON" of the temporary ACK creation halt flag shown in the distribution managed table 1 and drawing 6 mentioned later, and "OFF", when it is judged that the data packet saved at the tmpACK buffer 4 is not a packet (SYN+ACK) in step S52 (steps S52 and NO) ] -- and it judges that it is temporary ACK ready-for-sending ability (step S54). From the segment X which is going to create tmpACK, a judgment whether the data segment required for transmission of tmpACK was received can be made on mounting of enabling creation of tmpACK to Segment X, when one or more segments of a next sequence number receive.

[0061] In step S54, when the ACK segment which is not transmitted [ which is in the tmpACK buffer 4 when it is judged that the data segment required for transmission of tmpACK is not received (steps S54 and NO) ] exists, this ACK segment is transmitted to a terminal unit C1 (step S53), and a return is carried out to step S13.

[0062] On the other hand, when it is judged in step S54 that the data segment required for transmission of tmpACK was received (steps S54 and YES), the data segment from the terminal unit C1 set as the object of creation of tmpACK is determined (step S55). In processing of this step S55, it processes with reference to the SACK option of the window (Window) size of a terminal unit C1, the transmitting situation of tmpACK, and the TCP protocol between terminal units C [ C1 and ] 2 etc. using the distribution managed table 1.

[0063] For example, in the communication link without the SACK option, a sequence number determines a large thing as the 2nd as an object of tmpACK creation in the segment by which it is the waiting for ACK reception among the entries of the distribution managed table 1, tmpACK is not transmitted, and the segment with a small sequence number is altogether received in data distribution management equipment 10 as compared with the self-sequence number.

[0064] Then, the segment rewritten for the number which added "1" to the sequence number of the segment for tmpACK creation which determined the Acknowledgement number of the segment saved at the tmpACK creation buffer by step S55 is created as tmpACK (step S56). In the case of TCP with the SACK option, in step S55, it is also possible to determine the candidate for tmpACK creation in consideration of the SACK option, and to perform mounting which creates the confirmation-of-receipt response which also added the SACK option in step S56.

[0065] Then, tmpACK is transmitted to the terminal unit C1 which is a transmitting agency (step S57). Here, transmit timing is adjusted according to a window size. For example, after [ which is shown in a degree type (1) ] waiting latency-time WtimeNEW, it is made to transmit tmpACK. namely, --  $WtimeNEW = \text{Min}[\text{UBOUND and Max } [WtimeOLD - (\text{WindowSIZENEW} - \text{WindowSIZEOLD})]$



\*alpha, LBOUND]] -- (1)

It comes out. Here, it is the current latency time, and "LBOUND" is the upper limit of the waiting for transmission, for example, "WtimeNEW" is set to the resending time out value in a terminal unit C1 etc. Moreover, "WtimeOLD" is "WtimeNEW" computed last time, and initial value is "LBOUND." "WindowSIZENEW" is the window size of the current terminal unit C1, and "WindowSIZEOLD" is the window size of the last terminal unit C1. "LBOUND" is the lower limit of the waiting for transmission, "0", and "alpha" expresses the predetermined number for computing "WtimeNEW". [ for example, ]

[0066] After transmitting tmpACK to a transmitting agency, a setting change is made tmpACK transmitting ending (step S58), and the return of the information on the segment which has carried out the entry on all the distribution managed tables 1 corresponding to tmpACK which transmitted is carried out to step S13.

[0067] Below, with reference to the flow chart shown in drawing 8, the procedure of the confirmation-of-receipt processing by SG distribution Management Department 16 of data distribution management equipment 10 and the resending control processing by the result is explained. This confirmation-of-receipt processing and resending control processing are arranged in parallel with the check processing of a packet and tmpACK use control processing which were shown in drawing 2, and are processed.

[0068] In drawing 8, it judges whether the event which shows arrival of the confirmation-of-receipt response from a terminal unit C2 first was received (step S61). This event is an event generated in processing of the check of the packet in step S11. It judges whether when the confirmation-of-receipt response has arrived (steps S61 and YES), it is the notice of initiation from a terminal unit C2 (step S69), and this processing is ended when it is the notice of initiation (steps S69 and YES). On the other hand, when it is judged that it is not the notice of initiation from a terminal unit C2 (steps S61 and NO), the result which receives the data segment which the received confirmation-of-receipt response shows in the distribution managed table 1 is filled in (step S70). For example, in the communication link without the SACK option, as compared with the data segment which the confirmation-of-receipt response which is the waiting for ACK reception among the entries of the distribution managed table 1, and was received shows, a sequence number makes all the small data segments ACK receiving settled. On the other hand, in the communication link with a SACK option, as compared with the data segment which the confirmation-of-receipt response which is the waiting for ACK reception among the entries of the distribution managed table 1, and was received shows, a sequence number is a small data segment, and suppose finishing [ ACK reception of all the data segments that are not in the SACK option ].

[0069] A segment [ finishing / ACK reception / among the entries of the distribution managed table 1 ] is deleted from a transmission buffer 6 after processing of step S70 (step S71). The deletion of an ACK receiving segment has a timer about deletion, packs it for every fixed time amount, and you may make it delete it here.

[0070] On the other hand, when it is judged in step S61 that the event of the confirmation-of-receipt response reception from a terminal unit C2 is not received, it judges whether the resending time-out occurred further (step S62). When the resending time-out has not occurred (steps S62 and NO), this processing is ended as it is. On the other hand, when it is judged that the resending time-out occurred (steps S62 and YES), it judges whether transmission of tmpACK is suspended (step S63).

[0071] Data distribution management equipment 10 has the false window (thing imitating the window in a TCP communication link) united with the receive buffer 7 here. The amount which subtracted the daily dose which remains in the receive buffer 7 from this false window size, Namely, the total amount of the segment received from the transmitting agency is subtracted from a false window size. The amount adding the total amount of the segment to which the confirmation-of-receipt response from the destination is furthermore coming When the size for further 1 segment is exceeded rather than the window size of the transmitting origin which it grasps in data distribution management equipment 10, It judges that tmpACK is not stopped (steps S63 and NO), the temporary ACK creation halt flag shown in drawing 6 is set as "OFF",

processing which starts transmission of tmpACK is performed (step S64), and it shifts to step S66.

[0072] On the other hand, when [ that ] reverse, it judges that tmpACK is stopped (steps S63 and YES), and the temporary ACK creation halt flag shown in drawing 6 is set as "ON", processing which suspends transmission of tmpACK is performed (step S65), and it shifts to step S66. Here, decision whether tmpACK mentioned above is stopped is explained concretely. When magnitude of the "y" cutting tool and one segment to receive was made into the "k" cutting tool for the total amount of the segment which is in the "m" cutting tool and the current receive buffer 7 about the window size of the transmitting origin C1, i.e., a terminal unit, the transmitting "X" cutting tool and the transmitting data distribution management equipment 10 at this time grasp the false window size and a degree type (2) is materialized, a judgment which stops temporary ACK is made, namely,  $X - y < m + k$  (2) ----- (2) ----- It comes out.

[0073] Then, the retry count of the entry of the data segment which the time-out in the distribution managed table 1 generated is incremented, a resending flag "is set" (step S66), and it judges that it is distribution termination (step S67). When the time-out of resending is repeated, data distribution management equipment 10 carries out retry out of resending, when exchange of the data packet of the distribution termination in the usual TCP communication link is detected or and it ends distribution, it is judged as distribution termination (steps S67 and YES), a distribution post process is performed (step S68), and this processing is ended. In addition, the time out value of resending and the count of retry out need to be set up longer enough than the time out value and the count of retry out of resending in a terminal unit C1 and a terminal unit C2.

[0074] Processing of step S68 performs processing which changes with distribution exit status. When exchange of the data packet of the distribution termination in the usual TCP communication link is detected, in the tmpACK buffers 4, transmission buffers 6, and all the receive buffers 7, all the data segments in the communication link to end are deleted, and the entry of the distribution managed table 1 is also deleted. In addition, the entry of the distribution managed table 1 can also serve as and save are recording of data. Moreover, unless it prepares a life in an entry or an entry overflows, you may leave.

[0075] On the other hand, when it is judged in step S67 that it is not distribution termination, resending processing of steps S72-S74 is performed. That is, at step S72, the resending flag of the distribution managed table 1 resends the data segment of a transmission buffer 6 for what is turned "on", and "clears" the resending flag of the distribution managed table 1. A resend timer is reset after processing of this step S72 (step S73), the increment of the retry count counter of data distribution management equipment 10 is performed (step S74), and this processing is ended.

[0076] gestalt 2. of operation -- below, the gestalt 2 of implementation of this invention is explained. With the gestalt 2 of this operation, the delay [ processing / which was shown in drawing 6 / tmpACK use control ] according to a window size is added, and it is made to perform creation processing and transmitting processing of tmpACK.

[0077] Drawing 9 is a flow chart which shows the tmpACK use procedure of the data distribution management equipment which is the gestalt 2 of implementation of this invention. In drawing 9, it judges whether the data packet of communication link termination is receiving settled with reference to the value of the flag set up by a series of processings shown in drawing 2 received [ FIN ] (step S81). When finishing [ FIN packet reception ] is judged (steps S81 and YES), a return is carried out to step S13 as it is.

[0078] On the other hand, when finishing [ FIN packet reception ] is not judged (steps S81 and NO), it judges whether the flag which shows that the time delay for temporary ACK passed stands (step S82). When the time delay for temporary ACK has passed (steps S82 and YES), a delay temporary ACK timer and a related flag are reset (step S83).

[0079] An updating setup of the delay temporary ACK timer value according to a window size is carried out using [ at this time, for example, the correspondence table shown in drawing 10 , ]. For example, in drawing 10, when a window size is more than "5" kbyte, an updating setup of

the delay timer is carried out at "5" msec. Then, it shifts to step S84.

[0080] When it is judged in step S82 that the time delay for temporary ACK has not passed, it sets to data distribution management equipment 10. When it judges whether there are any non-transmitted data to a terminal unit C1 (step S86) and there are no non-transmitted data (steps S86 and NO), a return is carried out to step S13, and when there are non-transmitted data (steps S86 and YES), it shifts to step S87.

[0081] In step S87, it judges whether the data packet saved at the tmpACK buffer 4 is a packet (SYN+ACK), and when it is a packet (SYN+ACK), a non-transmitted packet (SYN+ACK) is transmitted to the destination (step S85), and a return is carried out to step S13.

[0082] On the other hand, when it is judged that the data packet saved at the tmpACK buffer 4 is not a packet (SYN+ACK) in step S87, it judges whether the data segment required for transmission of tmpACK is received (step S88). In processing of step S84 and step 88, it reaches [ whether the segment required for transmission of tmpACK was received and ] with reference to ON of the distribution managed table 1 and a temporary ACK creation flag, and OFF, and judges whether transmission of tmpACK is possible. That is, it judges whether tmpACK with delay is used. When decision whether the segment required for tmpACK transmission was received receives one or more segments of the sequence number after the segment X which is going to create tmpACK, creation of tmpACK to Segment X of it is enabled.

[0083] In step S84, when it is judged that tmpACK with delay is not used, the ACK packet which is not transmitted in the tmpACK buffer 4 is transmitted to a terminal unit C1 (step S85), and a return is carried out to step S13.

[0084] On the other hand, when it is judged in steps S84 and S88 that tmpACK with delay is used, the data segment from the terminal unit C1 set as the object of creation of tmpACK is determined (step S89). In processing of this step 89, it processes with reference to the SACK option of the receiving situation in data distribution management equipment 10, the window size of a transmitting agency, the transmitting situation of tmpACK, and the TCP protocol between a terminal unit C1 and a terminal unit C2 etc. using the distribution managed table 1.

[0085] For example, in the communication link without the SACK option, a sequence number determines a large thing as the 2nd as a candidate for tmpACK creation in the segment by which it is the waiting for ACK reception among the entries of the distribution managed table 1, tmpACK is not transmitted, and the segment with a small sequence number is received in all the data distribution management equipments 10 as compared with the self-sequence number.

[0086] Moreover, for example, in the communication link with a SACK option, it is tmpACK ready-for-sending ability. And it has not tmpACK transmitted and is the waiting for ACK reception. In the segment which the segment group which is not received [ in which a self-sequence number has the sequence number which continued among small segments ] has received in the data distribution management equipment 10 which is four or less A sequence number determines the segment in front of one as creation of tmpACK, and an object of transmission rather than the rearmost thing.

[0087] The data segment rewritten for the number which added "1" to the sequence number of the data segment for [ of tmpACK which determined the attainment Acknowledgement number of the data segment saved at the tmpACK buffer 4 in step S89 ] creation is created as tmpACK after processing of step S89. In the case of TCP with the SACK option, mounting which creates tmpACK which took the SACK option into consideration in step S89 is also possible. Then, in step S90, the confirmation-of-receipt response which also added the SACK option is created.

[0088] the information on the data segment which has carried out the entry on all the distribution managed tables 1 on which tmpACK is transmitted to a terminal unit C1 after processing of step S90 (step S91), and this tmpACK that transmitted corresponds -- tmpACK transmission -- finishing -- a modification setup is carried out (step S92), and a return is carried out to step S13.

[0089]

[Effect of the Invention] As explained above, according to this invention, a maintenance means holds the information on the window size of said 1st terminal unit. It is determined whether a decision means performs return processing of said confirmation-of-receipt response based on

the information on the window size which said maintenance means holds. Only when a control means determines that said decision means will perform return processing of said confirmation-of-receipt response, it is made to perform return processing of said confirmation-of-receipt response. Since he is trying to adjust the transmit timing or the amount of transmission of a confirmation-of-receipt response to a transmitting agency The effectiveness that the data distribution management equipment which can avoid the increment in a high speed and the rapid data transmitting rate which does not balance the situation of a transmitting agency while being able to perform data distribution efficiently, or the amount of data is realizable is further done so.

[0090] According to the next invention, a maintenance means holds the information on the window size of said 1st terminal unit. Since the control means is made to perform control to which it carries out adjustable [of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows.] The effectiveness that a high speed and the data distribution management equipment which can perform data distribution efficiently are further realizable is done so.

[0091] According to the next invention, a calculation means the predetermined lower limit which carried out abbreviation correspondence from the current time delay made into initial value to the time delay of the return time which returns a confirmation-of-receipt response to said 1st terminal unit from the reception time of the confirmation-of-receipt response received from said 2nd terminal unit The 2nd subtraction value which subtracted the 2nd value which carried out the multiplication of the predetermined value to the 1st subtraction value which subtracted the last window size from the current window size in said 1st terminal unit, Compute maximum with said predetermined lower limit, and the minimum value of this maximum and a predetermined upper limit is computed. The newest current time delay is computed by repeating the processing which resets this minimum value as said current time delay. Since said control means is made to perform control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the newest current time delay computed by said calculation means ] The effectiveness that a high speed and the data distribution management equipment which can perform data distribution efficiently are further realizable is done so.

[0092] According to the next invention, a maintenance means holds at least said window size of the 1st terminal unit, the number of segments of the data received from said 1st terminal unit, and the existence of the confirmation-of-receipt response from said 2nd terminal unit. It is determined whether a decision means returns said confirmation-of-receipt response to the data which said 1st terminal unit transmitted with the combination of said window size which said maintenance means holds, said number of segments, and the existence of said confirmation-of-receipt response. A control means Since it is made to return this confirmation-of-receipt response when it is determined that said decision means will return said confirmation-of-receipt response, the effectiveness that a high speed and the data distribution management equipment which can perform data distribution efficiently are further realizable is done so.

[0093] According to the next invention, a maintenance means holds the information on the window size of said 1st terminal unit. A control means the creation consistency of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows Adjustable, For example, since it is made to perform control which thins out a confirmation-of-receipt response, the effectiveness that a high speed and the data distribution management equipment which can perform data distribution efficiently are further realizable is done so.

[0094] According to the next invention, a data buffer holds the data which said 1st terminal unit transmitted at least. A management tool manages the registration information on the data which said 1st terminal unit transmitted at least. When the confirmation-of-receipt response to these data is received from said 2nd terminal unit with which the deletion control means transmitted the data which said 1st terminal unit transmitted, Since it is made to perform control which

deletes the registration information on these data that these data currently held at said data buffer and said management tool manage, the effectiveness that the load concerning data distribution management equipment is mitigable is done so.

[0095] Counting of the number [ finishing / the confirmation of receipt ] of segments whose means is data for [ of the data held in said data buffer ] deletion is carried out. according to the next invention -- counting -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said counting -- this confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds a predetermined number Since he is trying to delete the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages, the effectiveness that the load concerning data distribution management equipment is mitigable is done so.

[0096] Counting of the number [ finishing / the confirmation of receipt ] of segments whose means is data for [ of the data held in said data buffer ] deletion is carried out. according to the next invention -- the 1st counting -- A means carries out counting of the registration information on the data for [ of the data which said management tool manages ] deletion. the 2nd counting -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, The information about these data that said management tool manages is set as confirmation-of-receipt ending. said 1st counting -- the confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds the 1st predetermined number The data [ finishing / this confirmation of receipt ] currently held at said data buffer are deleted. said 2nd counting -- since he is trying to delete the registration information on data [ finishing / this confirmation of receipt ] when the registration information on the data [ finishing / the confirmation of receipt ] in which a means carries out counting exceeds the 2nd predetermined number, the effectiveness that the load concerning data distribution management equipment is mitigable is done so.

[0097] It has a means further. according to the next invention -- a time check -- the time check whose means clocks predetermined time -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. a time check, since he is trying to delete the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages when a means clocks said predetermined time The effectiveness that the load concerning data distribution management equipment is mitigable is done so.

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**TECHNICAL FIELD**

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[Field of the Invention] This invention is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. It is related with the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data. It is related with the data distribution management equipment which can improve the rate performance degradation depending on the receiving timing of the confirmation-of-receipt response especially at the time of data distribution.

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PRIOR ART

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[Description of the Prior Art] From the former, TCP of a transmitting side performs data transmission one after another by the communication link using TCP by having a window size corresponding to a transmission buffer, restricting in this window size, and making a transmit window slide. When it becomes the situation of having not accepted the confirmation-of-receipt response for a certain reason, temporarily, TCP judges that it is in a congestion condition, makes a window size small, by this, tends to lower a throughput and tends to cancel congestion.

[0003] However, while being large capacity like a satellite circuit, when TCP is physically used in the big circuit of a transit delay, 0.5 seconds or more may be taken for the confirmation-of-receipt response to this data to come on the contrary from data transmission with a physical distance. It is time amount until it judges the resending time-out time amount in general TCP, i.e., data transmission, to be failure for these 0.5 seconds and starts data resending, and TCP is the time amount judged that the congestion condition has arisen. Consequently, the trouble that the rate engine performance which balanced the mass magnitude of circuit original like a satellite circuit, i.e., a throughput, cannot be demonstrated arises.

[0004] Drawing 11 is the block diagram showing the configuration of the data distribution managerial system which used conventional data distribution management equipment (Information Processing Society of Japan research report 98-DPS-89 -12 reference). This data distribution managerial system is a system which can solve the trouble mentioned above and can raise a throughput. In drawing 11, this data distribution managerial system has the transmitting gateway 100 connected to a sending set C11, a receiving set C12, and this sending set C11 and receiving set C12 through the circuits L11 and L12 which perform the communication link by TCP, respectively. A circuit L12 is a circuit with a large transit delay as compared with a circuit L11, for example, is a satellite circuit.

[0005] In drawing 11, a sending set C11 has the data packet output section 111 which outputs a data packet, and the temporary confirmation-of-receipt response receive section 112 which receives the temporary attainment Acknowledgement which the transmitting gateway 100 created. While the transmitting gateway 100 has a buffer 101 and the distribution managed table 102 The are recording section 103 which the data packet transmitted from the sending set C11 is received [ section ], and stores up this data packet in a buffer 101, The output section 104 which outputs the data data packet accumulated in the buffer 101 through the circuit L12 to a receiving set C12, The temporary confirmation-of-receipt response creation section 105 which creates the temporary confirmation-of-receipt response to the data packet which transmitted to the receiving set C12, The temporary confirmation-of-receipt response transmitting section 106 which transmits this created temporary confirmation-of-receipt response to a sending set C11, With the temporary confirmation-of-receipt response receive section 107 which receives the confirmation-of-receipt response sent from the receiving set C12 Communication link information is acquired from the SYN (connection request) packet which received, and it has the delivery information storage control section 108 recorded on the distribution managed table 102 as delivery information, and the resending processing section 109 which performs resending processing of a data packet. Moreover, a receiving set C12 has the data packet receive section 121 which receives the data packet sent from the transmitting gateway 100, and the

confirmation-of-receipt responded-output section 122 which outputs a confirmation-of-receipt response to the transmitting gateway 100.

[0006] If a data packet is sent out from a sending set C11, the transmitting gateway 100 will add the entry of this data packet to the distribution managed table 102 while accumulating the data packet which received in a buffer 101 temporarily. The transmitting gateway 100 creates the data packet of a temporary attainment Acknowledgement to this data packet, and transmits this temporary attainment Acknowledgement to a sending set C11 while it transmits the data packet which received from the sending set C11 to a receiving set C12 through a circuit L12.

[0007] If a data packet is received from the transmitting gateway 100, a receiving set C12 will create the confirmation-of-receipt response to this receiving data packet, and will transmit this confirmation-of-receipt response to the transmitting gateway 100. The data about a corresponding data packet and the data about the attainment check situation of this data packet are contained in this confirmation-of-receipt response. The transmitting gateway 100 which received the confirmation-of-receipt response from the receiving set C12 is a data packet currently held in the transmitting gateway 100, and clears the data packet corresponding to this confirmation-of-receipt response.

[0008] Here, in the process in which a data packet is transmitted to a receiving set C12 from the transmitting gateway 100, when a transfer of this data packet goes wrong and a receiving set C12 is not able to receive this data packet, from a receiving set C12 side, three same confirmation-of-receipt responses are continued, it receives, and the transmitting gateway 100 performs resending processing of this data packet.

[0009] Thus, in the conventional data distribution managerial system, by returning a temporary confirmation-of-receipt response (tmpACK) to the transmission and coincidence of a data packet to a receiving set C12 from the transmitting gateway 100 to a sending set C11, the transmitting gateway 100 prevented reduction of the window size of TCP by \*\*\*\*\* of a circuit L12, lost the fall of a throughput, and has improved degradation of the rate engine performance.

[0010] Moreover, when the transmitting gateway 100 will hold this data packet and will receive three same confirmation-of-receipt responses (DuplicateACK) until it creates a temporary confirmation-of-receipt response and receives the confirmation-of-receipt response (ACK) from a receiving set if a data packet is received from a sending set, it judges transmission of this data packet to be failure, and is made to resend this data packet currently held.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] As explained above, according to this invention, a maintenance means holds the information on the window size of said 1st terminal unit. It is determined whether a decision means performs return processing of said confirmation-of-receipt response based on the information on the window size which said maintenance means holds. Only when a control means determines that said decision means will perform return processing of said confirmation-of-receipt response, it is made to perform return processing of said confirmation-of-receipt response. Since he is trying to adjust the transmit timing or the amount of transmission of a confirmation-of-receipt response to a transmitting agency The effectiveness that the data distribution management equipment which can avoid the increment in a high speed and the rapid data transmitting rate which does not balance the situation of a transmitting agency while being able to perform data distribution efficiently, or the amount of data is realizable is further done so.

[0090] According to the next invention, a maintenance means holds the information on the window size of said 1st terminal unit. Since the control means is made to perform control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows ] The effectiveness that a high speed and the data distribution management equipment which can perform data distribution efficiently are further realizable is done so.

[0091] According to the next invention, a calculation means the predetermined lower limit which carried out abbreviation correspondence from the current time delay made into initial value to the time delay of the return time which returns a confirmation-of-receipt response to said 1st terminal unit from the reception time of the confirmation-of-receipt response received from said 2nd terminal unit The 2nd subtraction value which subtracted the 2nd value which carried out the multiplication of the predetermined value to the 1st subtraction value which subtracted the last window size from the current window size in said 1st terminal unit, Compute maximum with said predetermined lower limit, and the minimum value of this maximum and a predetermined upper limit is computed. The newest current time delay is computed by repeating the processing which resets this minimum value as said current time delay. Since said control means is made to perform control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the newest current time delay computed by said calculation means ] The effectiveness that a high speed and the data distribution management equipment which can perform data distribution efficiently are further realizable is done so.

[0092] According to the next invention, a maintenance means holds at least said window size of the 1st terminal unit, the number of segments of the data received from said 1st terminal unit, and the existence of the confirmation-of-receipt response from said 2nd terminal unit. It is determined whether a decision means returns said confirmation-of-receipt response to the data which said 1st terminal unit transmitted with the combination of said window size which said maintenance means holds, said number of segments, and the existence of said confirmation-of-receipt response. A control means Since it is made to return this confirmation-of-receipt

response when it is determined that said decision means will return said confirmation-of-receipt response, the effectiveness that a high speed and the data distribution management equipment which can perform data distribution efficiently are further realizable is done so.

[0093] According to the next invention, a maintenance means holds the information on the window size of said 1st terminal unit. A control means the creation consistency of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows Adjustable, For example, since it is made to perform control which thins out a confirmation-of-receipt response, the effectiveness that a high speed and the data distribution management equipment which can perform data distribution efficiently are further realizable is done so.

[0094] According to the next invention, a data buffer holds the data which said 1st terminal unit transmitted at least. A management tool manages the registration information on the data which said 1st terminal unit transmitted at least. When the confirmation-of-receipt response to these data is received from said 2nd terminal unit with which the deletion control means transmitted the data which said 1st terminal unit transmitted, Since it is made to perform control which deletes the registration information on these data that these data currently held at said data buffer and said management tool manage, the effectiveness that the load concerning data distribution management equipment is mitigable is done so.

[0095] Counting of the number [ finishing / the confirmation of receipt ] of segments whose means is data for [ of the data held in said data buffer ] deletion is carried out. according to the next invention -- counting -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said counting -- this confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds a predetermined number Since he is trying to delete the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages, the effectiveness that the load concerning data distribution management equipment is mitigable is done so.

[0096] Counting of the number [ finishing / the confirmation of receipt ] of segments whose means is data for [ of the data held in said data buffer ] deletion is carried out. according to the next invention -- the 1st counting -- A means carries out counting of the registration information on the data for [ of the data which said management tool manages ] deletion. the 2nd counting -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, The information about these data that said management tool manages is set as confirmation-of-receipt ending. said 1st counting -- the confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds the 1st predetermined number The data [ finishing / this confirmation of receipt ] currently held at said data buffer are deleted. said 2nd counting -- since he is trying to delete the registration information on data [ finishing / this confirmation of receipt ] when the registration information on the data [ finishing / the confirmation of receipt ] in which a means carries out counting exceeds the 2nd predetermined number, the effectiveness that the load concerning data distribution management equipment is mitigable is done so.

[0097] It has a means further. according to the next invention -- a time check -- the time check whose means clocks predetermined time -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. a time check, since he is trying to delete the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages when a means clocks said

predetermined time The effectiveness that the load concerning data distribution management equipment is mitigable is done so.

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] however, in the conventional data distribution managerial system When a data segment is received from a sending set C11, the transmitting gateway 100 The transceiver buffer of a sending set C11 or the condition of a window, the \*\* that does not take into consideration the congestion condition of a circuit L11 further, Since the temporary confirmation-of-receipt response to all data segments is created immediately and he was trying to transmit to a sending set C11, the processing load of the transmitting gateway 100 and a sending set C11 became large, and there was a trouble that the case where the rate engine performance deteriorates as a result arose.

[0012] Moreover, although transmitted by the throughput determined according to the condition of the receiving window of the sending set C11 which the receiving set C12 grasps, data including the confirmation-of-receipt response transmitted from the receiving set C12 When data are received in the transmitting gateway 100 Since data transfer was performed by the throughput based on the last old window size, When the receive buffers or receiving windows of a sending set C11 are decreasing in number, It could not respond to the condition of the receive buffer or receiving window where the sending set C11 was updated, but there was a trouble that the receive buffer and window of a sending set C11 may cause overflow.

[0013] This invention was made in view of the above, adjusts the transmit timing or the amount of transmission of a temporary confirmation-of-receipt response in consideration of conditions, such as congestion of a transceiver buffer, a window size, and a circuit, and aims at obtaining further a high speed and the data distribution management equipment which can perform data distribution efficiently.

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MEANS

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[Means for Solving the Problem] In order to attain the above-mentioned purpose, the data distribution management equipment concerning this invention It is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold the information on the window size of said 1st terminal unit, A decision means to determine whether perform return processing of said confirmation-of-receipt response based on the information on the window size which said maintenance means holds, When it is determined that said decision means will perform return processing of said confirmation-of-receipt response, it is characterized by having the control means which performs return processing of said confirmation-of-receipt response.

[0015] According to this invention, a maintenance means holds the information on the window size of said 1st terminal unit. It is determined whether a decision means performs return processing of said confirmation-of-receipt response based on the information on the window size which said maintenance means holds. Only when a control means determines that said decision means will perform return processing of said confirmation-of-receipt response, it is made to perform return processing of said confirmation-of-receipt response, and he is trying to adjust the transmit timing or the amount of transmission of a confirmation-of-receipt response to a transmitting agency.

[0016] The data distribution management equipment concerning the next invention is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold the information on the window size of said 1st terminal unit, It is characterized by having the control means which performs control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows ].

[0017] According to this invention, a maintenance means holds the information on the window size of said 1st terminal unit, and the control means is made to perform control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows ].

[0018] The data distribution management equipment concerning the next invention the predetermined lower limit which carried out abbreviation correspondence from the current time delay made into initial value to the time delay of the return time which returns a confirmation-of-receipt response to said 1st terminal unit in the above-mentioned invention from the reception time of the confirmation-of-receipt response received from said 2nd terminal unit The 2nd subtraction value which subtracted the 2nd value which carried out the multiplication of the predetermined value to the 1st subtraction value which subtracted the last window size from the current window size in said 1st terminal unit, Compute maximum with said predetermined lower limit, and the minimum value of this maximum and a predetermined upper limit is computed. It has further a calculation means to compute the newest current time delay by repeating the processing which resets this minimum value as said current time delay. Said control means It is characterized by performing control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the newest current time delay computed by said calculation means ].

[0019] According to this invention, a calculation means the predetermined lower limit which carried out abbreviation correspondence from the current time delay made into initial value to the time delay of the return time which returns a confirmation-of-receipt response to said 1st terminal unit from the reception time of the confirmation-of-receipt response received from said 2nd terminal unit The 2nd subtraction value which subtracted the 2nd value which carried out the multiplication of the predetermined value to the 1st subtraction value which subtracted the last window size from the current window size in said 1st terminal unit, Compute maximum with said predetermined lower limit, and the minimum value of this maximum and a predetermined upper limit is computed. The newest current time delay is computed by repeating the processing which resets this minimum value as said current time delay. It is made to perform control to which it carries out adjustable [ of the return timing of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the newest current time delay by which said control means was computed with said calculation means ].

[0020] The data distribution management equipment concerning the next invention is arranged on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold at least said window size of the 1st terminal unit, the number of segments of the data received from said 1st terminal unit, and the existence of the confirmation-of-receipt response from said 2nd terminal unit, A decision means to determine whether return said confirmation-of-receipt response to the data which said 1st terminal unit transmitted with the combination of said window size which said maintenance means holds, said number of segments, and the existence of said confirmation-of-receipt response, When it is determined that said decision means will return said confirmation-of-receipt response, it is characterized by having the control means which returns this confirmation-of-receipt response.

[0021] According to this invention, a maintenance means holds at least said window size of the 1st terminal unit, the number of segments of the data received from said 1st terminal unit, and the existence of the confirmation-of-receipt response from said 2nd terminal unit. It is determined whether a decision means returns said confirmation-of-receipt response to the data which said 1st terminal unit transmitted with the combination of said window size which said maintenance means holds, said number of segments, and the existence of said confirmation-of-receipt response. A control means When it is determined that said decision means will return said confirmation-of-receipt response, it is made to return this confirmation-of-receipt response.

[0022] The data distribution management equipment concerning the next invention is arranged

on the transmission line between the 1st terminal unit which performs the communication link which needs the confirmation-of-receipt response to the transmitted data, and the 2nd terminal unit which is the communications-partner point of this 1st terminal unit. The transit delay between said 1st terminal unit is small as compared with the transit delay between said 2nd terminal unit. In the data distribution management equipment which can perform return processing which creates and returns the confirmation-of-receipt response to the transfer processing which transmits the data from said 1st terminal unit to said 2nd terminal unit at least, and the this transmitted data A maintenance means to hold the information on the window size of said 1st terminal unit. It is characterized by having the control means which performs control to which it carries out adjustable [ of the creation consistency of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows ].

[0023] According to this invention, a maintenance means holds the information on the window size of said 1st terminal unit, and it is made to perform control whose control means thins out adjustable, for example, a confirmation-of-receipt response, for the creation consistency of said confirmation-of-receipt response to the data which said 1st terminal unit transmitted according to the window size which the information on the window size which said maintenance means holds shows.

[0024] The data buffer to which the data distribution management equipment concerning the next invention holds the data which said 1st terminal unit transmitted at least in the above-mentioned invention, The management tool which manages the registration information on the data which said 1st terminal unit transmitted at least, When the confirmation-of-receipt response to these data is received from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, It is characterized by having further the deletion control means which performs control which deletes the registration information on these data that these data currently held at said data buffer and said management tool manage.

[0025] According to this invention, a data buffer holds the data which said 1st terminal unit transmitted at least. A management tool manages the registration information on the data which said 1st terminal unit transmitted at least. When the confirmation-of-receipt response to these data is received from said 2nd terminal unit with which the deletion control means transmitted the data which said 1st terminal unit transmitted, It is made to perform control which deletes the registration information on these data that these data currently held at said data buffer and said management tool manage.

[0026] It has a means further. counting to which the data distribution management equipment concerning the next invention carries out counting of the number [ finishing / the confirmation of receipt ] of segments which is data for [ of the data held in said data buffer ] deletion in the above-mentioned invention -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit which transmitted the data with which said 1st terminal unit transmitted said deletion control means, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said counting -- this confirmation of receipt in which a means carries out counting -- finishing -- when the set-up number of segments exceeds a predetermined number, it is characterized by deleting the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages.

[0027] Counting of the number [ finishing / the confirmation of receipt ] of segments whose means is data for [ of the data held in said data buffer ] deletion is carried out. according to this invention -- counting -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said counting -- this confirmation of receipt in which a means carries out counting -- finishing -- when the set-up number of segments exceeds a predetermined number, he is trying to delete the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ],

and the data [ finishing / this confirmation of receipt ] which said management tool manages [0028] the 1st counting to which the data distribution management equipment concerning the next invention carries out counting of the number [ finishing / the confirmation of receipt ] of segments which is data for [ of the data held in said data buffer ] deletion in the above-mentioned invention -- with a means It has a means further. the 2nd counting which carries out counting of the registration information on the data for [ of the data which said management tool manages ] deletion -- said deletion control means Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, The information about these data that said management tool manages is set as confirmation-of-receipt ending. said 1st counting -- the confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds the 1st predetermined number the data [ finishing / this confirmation of receipt ] currently held at said data buffer -- deleting -- said 2nd counting -- when the registration information on the data [ finishing / the confirmation of receipt ] in which a means carries out counting exceeds the 2nd predetermined number, it is characterized by deleting the registration information on data [ finishing / this confirmation of receipt ].

[0029] Counting of the number [ finishing / the confirmation of receipt ] of segments whose means is data for [ of the data held in said data buffer ] deletion is carried out. according to this invention -- the 1st counting -- A means carries out counting of the registration information on the data for [ of the data which said management tool manages ] deletion. the 2nd counting -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, The information about these data that said management tool manages is set as confirmation-of-receipt ending. said 1st counting -- the confirmation of receipt in which a means carries out counting -- finishing, when the set-up number of segments exceeds the 1st predetermined number the data [ finishing / this confirmation of receipt ] currently held at said data buffer -- deleting -- said 2nd counting -- when the registration information on the data [ finishing / the confirmation of receipt ] in which a means carries out counting exceeds the 2nd predetermined number, he is trying to delete the registration information on data [ finishing / this confirmation of receipt ]

[0030] It has a means further. the time check whose data distribution management equipment concerning the next invention clocks predetermined time in the above-mentioned invention -- said deletion control means Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit which transmitted the data which said 1st terminal unit transmitted, Registration information is set as these data that said management tool manages confirmation-of-receipt ending. said time check -- when a means clocks said predetermined time, it is characterized by deleting the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages.

[0031] It has a means further. according to this invention -- a time check -- the time check whose means clocks predetermined time -- Each time of the reception of a confirmation-of-receipt response to these data from said 2nd terminal unit with which said deletion control means transmitted the data which said 1st terminal unit transmitted, these data that said management tool manages -- registration information -- the confirmation of receipt -- finishing -- setting up -- a time check -- when a means clocks said predetermined time, he is trying to delete the registration information on data [ finishing / this confirmation of receipt currently held at said data buffer ], and the data [ finishing / this confirmation of receipt ] which said management tool manages

[0032]

[Embodiment of the Invention] Hereafter, with reference to an accompanying drawing, the gestalt of suitable operation of the data distribution management equipment concerning this invention is explained to a detail.

[0033] Gestalt 1. drawing 1 of operation is the block diagram showing the configuration of the data distribution managerial system containing the data distribution management equipment



which is the gestalt 1 of implementation of this invention. In drawing 1 , a terminal unit C1 is connected to data distribution management equipment 10 through circuit 2a, data distribution management equipment 10 is connected to data distribution management equipment 20 through a circuit 3, and, as for this data distribution managerial system, data distribution management equipment 20 is connected to a terminal unit C2 through circuit 2b. A circuit 3 is a big circuit of transit delays, such as a satellite circuit, and circuit 2a and 2b are circuits with a small transit delay as compared with a circuit 3.

[0034] Data distribution management equipment 10 has gateway function part 10a, the distribution managed table 1, the protocol managed table 5, and a transmission buffer 6 and a receive buffer 7. With the communications department 17 where Gateway SG performs radial transfer of a data packet between terminal units C1 With the communications department 11 which performs radial transfer of a data packet between the terminal units C2 through data distribution management equipment 20 The tmpACK buffer 4 which saves the data packet for creating a temporary confirmation-of-receipt response (tmpACK), The tmpACK use judging section 12 which judges whether tmpACK is returned to the data packet which transmitted to the terminal unit C2, and the tmpACK creation section 13 which creates tmpACK based on the data packet which received from the terminal unit C1, The SGTimer count area 14 which the time-out time amount (SGTimer) of the confirmation-of-receipt response for every data packet is counted [ count area ] up, and generates the time-out event of the waiting for this confirmation-of-receipt response, The distribution data-logging section 15 which performs processing which writes the information on whether tmpACK was transmitted to the terminal unit C1, and the information about the confirmation-of-receipt response from a terminal unit C2 in the distribution managed table 1, It has SG distribution Management Department 16 which manages distribution of a data packet corresponding to the contents of a SGTimer value and the distribution managed table 1.

[0035] In addition, in drawing 1 , although the transmission buffer 6, the receive buffer 7, and the tmpACK buffer 4 are shown as a respectively separate buffer, they may be made to mount not only this but partial or all as the same buffer. Moreover, even if it is the case where it mounts as the same buffer even if it is the case where it mounts as a separate buffer, the increase in efficiency of management and retrieval can be attained by preparing the managed table which can be used with the information which includes control information etc. according to the management purpose and which is not illustrated, and mounting so that the storing location of packet data may be identifiable.

[0036] Data distribution management equipment 20 has the same configuration as data distribution management equipment 10. Data distribution management equipment 10 transmits the data packet transmitted from the terminal unit C1 to a terminal unit C2 through data distribution management equipment 20. Under the present circumstances, data distribution management equipment 10 receives the data packet which received from the terminal unit C1 in the tmpACK use judging section 12. When judged with judging and applying whether the return function of tmpACK is applied, The temporary attainment Acknowledgement (tmpACK) to the data packet transmitted to the terminal unit C1 is returned. Data distribution management equipment 20 Only routing processing which transmits the data packet sent from data distribution management equipment 10 to a terminal unit C2 like the usual gateway is performed, and return processing of tmpACK is not performed. Moreover, data distribution management equipment 20 transmits the data packet transmitted from the terminal unit C2 to a terminal unit C1 through data distribution management equipment 10. Under the present circumstances, data distribution management equipment 20 receives the data packet which received from the terminal unit C2 in the tmpACK use judging section 12. When judged with judging and applying whether the return function of tmpACK is applied, tmpACK to the data packet transmitted to the terminal unit C2 is returned. Data distribution management equipment 10 Only routing processing which transmits the data packet sent from data distribution management equipment 20 to a terminal unit C1 like the usual gateway is performed, and return processing of tmpACK is not performed. Two-way communication between terminal units C [ C1 and ] 2 is realized by this. In addition, although a terminal unit C1 considers as a transmitting-side terminal, a terminal unit C2

considers as a receiving-side terminal and processing of data distribution management equipment 10 of operation is explained by the following explanation, processing of data distribution management equipment 20 when a terminal unit C2 considers as a transmitting-side terminal and a terminal unit C1 carries out a receiving-side terminal of operation is the same as data distribution management equipment 10.

[0037] Here, with reference to drawing 2 - drawing 8, data distribution management processing of data distribution management equipment 10 is explained. First, if the communications departments 17 and 11 of Gateway SG receive a data packet, this data packet that received is saved at a receive buffer 7 temporarily, and SG distribution Management Department 16 performs message distribution processing shown in drawing 2.

[0038] In drawing 2, the tmpACK use judging section 12 checks the data packet which received first, it opts for "ON" of a tmpACK available flag to the receiving data packet which data distribution management equipment 10 has according to this check result, and "OFF", and the information on a receiving data packet including "ON" of a tmpACK available flag, and "OFF" is registered into the distribution managed table 1 if needed (step S11).

[0039] Then, it judges whether use control of tmpACK is performed based on a tmpACK control flag (step S12). In not performing use control of tmpACK (steps S12 and NO), it ends this processing as it is, and in performing use control of tmpACK (steps S12 and YES), tmpACK use control processing is performed (step S13), and it ends this processing.

[0040] Drawing 3 is a flow chart which shows the check procedure of the packet in step S11 shown in drawing 2. In drawing 3, data distribution management equipment 10 first judges whether the IP address of the data packet which received is a right IP address, and it is the transfer the transmission place of the data packet which received minded the big circuit of delay using path managed table 1a (step S21). At this step S21, it checks whether the header of a network layer is an IP header, and judges whether a transit delay circuit exists after that on the path determined by the routing function using the distribution managed table 1. When the protocol does not use IP, it is not the address of a right format and a transit delay circuit does not exist on the path to the destination further (steps S21 and NO), a tmpACK available flag is set as "OFF" (step S22), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11. In addition, when using the managed table which is prepared in the separate buffer or the same buffer mentioned above and which is not illustrated, you may make it hold this tmpACK available flag as information in this managed table.

[0041] Here, drawing 4 is drawing showing the contents of path managed table 1a. In drawing 4, for every destination IP, the path to the destination is managed by this path managed table 1a, and existence is described for delay for every path. For example, although four paths of path "1" - "4" are listed when Destination IP is "10.74.3.200", the path of a path "1" turns into a path with delay. Therefore, when a path "1" is chosen, it is judged that it is the transfer to the circuit of delay dependence.

[0042] Then, when the IP address of the data packet which received is right and a transit delay exists in the path to the destination (steps S21 and YES), the tmpACK use judging section 12 judges whether the protocol of IP header is delay dependence using the protocol managed table 5 (step S24). When the protocol of IP header is delay dependence (steps S24 and YES), it judges whether the transmit port of a TCP header is delay dependence further (step S25). When the protocol of IP header is not delay dependence (steps S24 and NO), and when the transmit port of a TCP header is not delay dependence (steps S25 and NO), a tmpACK available flag is set as "OFF" (step S22), the data packet which received further is transmitted to the destination (step S23), and a return is carried out to step S11.

[0043] Here, drawing 5 is drawing showing an example of the judgment table in the protocol managed table 5 which the tmpACK use judging section 12 uses. In drawing 5, the item D1 of a reference header shows the header unit used for the judgment of the data packet for a judgment. Moreover, the item D2 of a protocol name shows the classification item of the protocol of the data in the header unit specified by the item D1 of a reference header. Furthermore, the information which shows whether the item D3 of spoofing use propriety is the protocol which should use return processing of tmpACK is expressed. If concrete decision

processing of steps S24 and S25 based on this judgment table is explained, it will set to step S24 first. The tmpACK use judging section 12 When judged with having received the data of TCP with reference to the sequence of bytes which shows the protocol of received IP header of a data packet, it sets to step S25. When judged with it not being BGP with reference to the transmitting agency port number of a TCP header unit, it can be judged that return processing of tmpACK can be used. On the other hand, when the data of BGP are received, it can be judged that return processing of tmpACK cannot be used.

[0044] Moreover, in step S24, when the higher-level protocol in the protocol section of IP header is not a protocol of delay dependence in data distribution management equipment 10 (steps S24 and NO), as mentioned above, a tmpACK available flag "is cleared" (step S22), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11. On the other hand in step S24, a higher-level protocol is judged to be the protocol of delay dependence, in step S25 also when it is not the protocol of the delay dependence based on the transmitting agency port number of a TCP header, as mentioned above, a tmpACK available flag "is cleared" (step S22), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11.

[0045] Now, in steps S24 and S25, when it is judged that it is the protocol of delay dependence, with reference to the value of the code bit of the header unit of the data packet which received, it judges whether it is a data packet at the time of communication link initiation (step S26). The buffer of dedication is formed as a packet buffer at the time of the initiation which is not illustrated. Or it is good also as a packet buffer at the time of the initiation which is not illustrated using buffers, such as a receive buffer 7 and a transmission buffer 6. In addition, a tag is attached for every class of every communication link at the time of defining what has the same equipment and the same communication link port which communicate as one communication link, and communication link, and you may make it manage the whole combination of the sending set which communicates the data packet saved at a packet buffer at the time of the initiation which is not illustrated every sending set and the whole receiving set, and a receiving set.

[0046] In not being a data packet at the time of communication link initiation (steps S26 and NO), the data packet which received judges whether it is a registered communication link already on the distribution managed table 1 (step S27). At this step S27, all of combination with the transmitting agency port the transmitting agency IP of an in [ IP header ] and in a TCP header and the combination of Destination IP and a destination port make the same communication link the same management unit, and it is judged that it is a registered communication link.

[0047] Here, drawing 6 is drawing showing an example of a distribution managed table. In drawing 6, items D11-D 16 are items showing the information about the communication link with the same management unit, and items D17-D 19 are items showing the information about the data packet which data distribution management equipment 10 received in the communication link with the same management unit. Each items D11-D 19 are the information acquired from the data packet which data distribution management equipment 10 received. An item D13 expresses a transmitting agency port number, an item D14 expresses a destination port number, an item D11 expresses the transmitting agency IP address of the communication link to manage, and the item D16 expresses [ an item D12 expresses a destination IP address, and / an item D15 shows a temporary ACK halt flag and ] each newest transmitting window size and newest receiving window size in a transmitting agency and the destination. Moreover, an item D17 expresses the sequence number of the data segment which data distribution management equipment 10 received in this communication link, and the item D18 expresses the information about transmission of tmpACK. The information on whether the information and tmpACK of whether to be the data packet which can transmit were transmitted including the case of conditioning when certain conditions are ready to a transmitting agency etc. is used for the information on this item D18 as a value. moreover, finishing [ an item D19 / the data packet which expresses the information over the confirmation-of-receipt response (RRACK) from the destination, and corresponds in drawing 6 / reception of RRACK ] -- it is -- it has two values of the "ACK waiting" showing being in the condition of waiting for the attainment showing things of "finishing

[ ACK reception ]" and RRACK.

[0048] In drawing 6 in a line DD 1 for example, from the transmit port "FTP.DATA" of the terminal unit "10.74.3.177" of a transmitting agency In the communication link to the destination port "1301" of the terminal unit "10.74.3.200" of the destination A temporary ACK halt flag is "OFF". The transmitting window size and receiving window size of a transmitting agency, And the data packet which all of the transmitting window size and receiving window size of the destination are 16 K bytes, and has a sequence number "398" Even when transmission of tmpACK becomes that is, improper [ "improper" ] and what kind of conditions, it is the data packet which does not transmit tmpACK and expresses that it is in the condition of waiting for the confirmation-of-receipt response from the destination at present.

[0049] SG distribution Management Department 16 can perform management of the transmission buffer 6 of control of the transmitting rate of RRACK which is the confirmation-of-receipt response from tmpACK and the destination to control [ of resending according to the management, the confirmation of receipt, and the receiving result of tmpACK of a data packet ], and transmitting origin, control of the transfer rate to the destination, and data distribution management equipment 10, and a receive buffer 7 using the item added if needed [ the item and if needed ] this distribution managed table 1 mentioned above.

[0050] It judges whether data distribution management equipment 10 has the communication link expressed with combination with the transmitting agency port the transmitting agency IP of an in [ IP header ], and in a TCP header, and the combination of Destination IP and a destination port in the distribution managed table 1 with reference to the transmitting agency port number and the destination port number in the transmitting agency IP address in received IP header of a data packet, a destination IP address, and a TCP header using this distribution managed table 1. When it is the communication link which is not registered into the distribution managed table 1 as a result of this decision (steps S27 and NO), it will shift to step S22.

[0051] Moreover, when it is judged that it is the communication link registered into the distribution managed table 1 (steps S27 and YES), Shift to step S31 and the data packet which received judges whether it is a data packet in the receiving window of the destination. When it is a data packet in the receiving window of the destination (steps S31 and YES), When it shifted to step S32 and is not a data packet in the receiving window of the destination (steps S31 and NO), A tmpACK available flag "is cleared". On the distribution managed table 1 The information about a data packet is registered, a tmpACK available flag is set as "OFF" (step S39), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11.

[0052] On the other hand, when it is judged in step S32 that it is not the data packet of communication link termination, it shifts to step S34. The distribution managed table 1 is referred to in step S34. The Window size of a convention of the "transmitting Window size" of a transmitting agency, For example, the Window size of a convention of the "receiving Window size" of whether it has reached more than "2" and the destination, For example, when it judged whether it would have reached more than "2" and it is judged that both sides have reached regular Window size (steps S34 and YES), The tmpACK available flag of data distribution management equipment 10 is set as "OFF" (step S39), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11. Moreover, in step S32, when it is judged that it is the data packet of communication link termination (steps S32 and YES), it shifts to step S40. At step S40, improper [ "improper" ] and "finishing [ FIN flag reception ]" are put into the item D18 about tmpACK transmission of the distribution managed table shown in drawing 6, and it shifts to it at step S23.

[0053] On the other hand, when Window size is judged not to be enough in step S34, it judges whether the data packet which received is the confirmation-of-receipt response from a terminal unit C2 (step S35). When it is judged that the data packet which received is not the confirmation-of-receipt response from a terminal unit C2 (steps S35 and NO), information is registered into the distribution managed table 1, a tmpACK available flag is set as "ON" (step S37), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11. In addition, the data packet "set" the tmpACK available flag is saved at

a transmission buffer 6. In case step S37 is processed, depending on mounting, the information on whether use of tmpACK is possible is set up as information in the arrival time point of the newest data packet for every entry of the information about each data packet of the distribution managed table 1. This can perform fine control according to the condition of the window size of not performing tmpACK use control for example, at the time of a slow start.

[0054] When it is judged that the data packet which received is the confirmation-of-receipt response from a terminal unit C2 (steps S35 and YES), At the tmpACK buffer 4, save the data packet which received, and it is received at SG distribution Management Department 16 of data distribution management equipment 10. The event which notifies having received the confirmation-of-receipt response from the terminal unit C2 is generated, a tmpACK available flag is set as "ON" (step S36), and a return is carried out to step S11. In addition, processing of this step S36 can also save only the required parts of for example, IP header, IP data division, etc. by mounting. Moreover, the data packet which received judges whether it is a data packet after what was already registered as a data packet for tmpACK creation, and you may make it register the data packet of the newest, i.e., the very back, as a data packet for tmpACK creation by a sequence number etc. Moreover, in step S35, also when the data packet which received is not the confirmation-of-receipt response from a terminal unit C2 (steps S35 and NO), it is also possible to save the data packet which received at the tmpACK buffer 4, and to use the data for tmpACK creation time as an object for tmpACK creation.

[0055] On the other hand, when it is judged in step S26 that it is the data packet of communication link initiation, it judges whether it is correctly transmitted and received as the procedure of a communication link of the data packet of communication link initiation including the data packet which is making a current judgment (step S29). According to a series of activities, the data packet of communication link initiation is saved at a packet buffer at the time of the initiation which does not illustrate only the thing which had it checked to have reached in order of the right. Therefore, what is necessary will be just to check either of whether decision of this step S29 is the data packet which should be received by the degree of the data packet for the time of the communication link initiation received by the last in whether the data packet which received is a data packet for the time of the first communication link initiation, and the same communication link.

[0056] Then, when data distribution management equipment 10 is judged to have received the data packet of communication link initiation in right sequence (steps S29 and YES), additional registration of the information on this data packet is carried out at the distribution managed table 1 (step S30). Then, when it judges whether the data packet which received is the confirmation-of-receipt response from a terminal unit C2 (step S41) and it is judged that it is the confirmation-of-receipt response from a terminal unit C2 (steps S41 and YES), after processing step S36 mentioned above, a return is carried out to step S11. On the other hand, when it is judged that it is not the confirmation-of-receipt response from a terminal unit C2 (steps S41 and NO), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11.

[0057] On the other hand, it sets to step S29. When it is judged that it is not the communication link registered into the distribution managed table 1 in step S27 when data distribution management equipment 10 is judged to have not received the data packet of communication link initiation in right sequence (steps S29 and NO) (steps S27 and NO), The tmpACK available flag of data distribution management equipment 10 "is cleared" (step S22), the data packet which received is transmitted to the destination (step S23), and a return is carried out to step S11.

[0058] Below, with reference to the flow chart shown in drawing 7, the detailed level procedure of the tmpACK use control processing by step S13 shown in drawing 2 is explained. Drawing 7 is a flow chart which shows the adjustment procedure of the transmit timing of tmpACK according to a window size. Here, a data segment is received and this adjustment processing is started with reference to a tmpACK use control flag by a tmpACK use control implementation event or the event outputted from the timer in connection with delay temporary ACK, or a counter. After delay temporary ACK waits for reception of fixed time amount or the number of fixed packets, it is creating and transmitting temporary ACK (tmpACK), and aims being the same as that of the

technique of the delay ACK in TCP etc. at urging processing of data distribution management equipment 10 and reduction of the flows between data distribution management equipment 10. [0059] With therefore, the event which the timer in connection with delay temporary ACK and a counter output In for example, the case of mounting using delay temporary ACK by the approach of performing creation and transmission of delay temporary ACK after waiting fixed time. The timer with which the tmpACK use judging section 12 measures the timing which generates delay temporary ACK, It has the delay temporary ACK time amount progress flag with which the value of ON and OFF is set up by a time-out time amount variable or a constant, and them, and it generates in order to tell that the latency time for delay temporary ACK came to the tmpACK creation section 13 for every fixed time amount.

[0060] In drawing 7 , it judges whether the data packet of communication link termination is receiving settled with reference to the value of the flag set up by a series of processings first shown in drawing 3 received [ FIN ] (step S51). When finishing [ FIN packet reception ] is judged (steps S51 and YES), a return is carried out to step S13 as it is. On the other hand, when finishing [ FIN packet reception ] is not judged (steps S51 and NO), it judges whether the data packets saved at the tmpACK buffer 4 are an SYN data packet and an ACK data packet (SYN+ACK) (packet) (step S52). (SYN+ACK) When it is a packet (steps S52 and YES), it transmits to the transmitting [ a non-transmitted packet (SYN+ACK) ] origin C1, i.e., a terminal unit, (step S53), and a return is carried out to step S13. a \*\*\*\*\* [ having, received the data segment required for transmission of tmpACK on the other hand, with reference to "ON" of the temporary ACK creation halt flag shown in the distribution managed table 1 and drawing 6 mentioned later, and "OFF", when it is judged that the data packet saved at the tmpACK buffer 4 is not a packet (SYN+ACK) in step S52 (steps S52 and NO) ] -- and it judges that it is temporary ACK ready-for-sending ability (step S54). From the segment X which is going to create tmpACK, a judgment whether the data segment required for transmission of tmpACK was received can be made on mounting of enabling creation of tmpACK to Segment X, when one or more segments of a next sequence number receive.

[0061] In step S54, when the ACK segment which is not transmitted [ which is in the tmpACK buffer 4 when it is judged that the data segment required for transmission of tmpACK is not received (steps S54 and NO) ] exists, this ACK segment is transmitted to a terminal unit C1 (step S53), and a return is carried out to step S13.

[0062] On the other hand, when it is judged in step S54 that the data segment required for transmission of tmpACK was received (steps S54 and YES), the data segment from the terminal unit C1 set as the object of creation of tmpACK is determined (step S55). In processing of this step S55, it processes with reference to the SACK option of the window (Window) size of a terminal unit C1, the transmitting situation of tmpACK, and the TCP protocol between terminal units C [ C1 and ] 2 etc. using the distribution managed table 1.

[0063] For example, in the communication link without the SACK option, a sequence number determines a large thing as the 2nd as an object of tmpACK creation in the segment by which it is the waiting for ACK reception among the entries of the distribution managed table 1, tmpACK is not transmitted, and the segment with a small sequence number is altogether received in data distribution management equipment 10 as compared with the self-sequence number.

[0064] Then, the segment rewritten for the number which added "1" to the sequence number of the segment for tmpACK creation which determined the Acknowledgement number of the segment saved at the tmpACK creation buffer by step S55 is created as tmpACK (step S56). In the case of TCP with the SACK option, in step S55, it is also possible to determine the candidate for tmpACK creation in consideration of the SACK option, and to perform mounting which creates the confirmation-of-receipt response which also added the SACK option in step S56.

[0065] Then, tmpACK is transmitted to the terminal unit C1 which is a transmitting agency (step S57). Here, transmit timing is adjusted according to a window size. For example, after [ which is shown in a degree type (1) ] waiting latency-time WtimeNEW, it is made to transmit tmpACK. namely, --  $WtimeNEW = \text{Min}[\text{UBOUND and Max} [WtimeOLD - (\text{WindowSIZENEW} - \text{WindowSIZEOLD}) * \alpha, \text{LBOUND}]]$

— (1)

It comes out. Here, it is the current latency time, and "LBOUND" is the upper limit of the waiting for transmission, for example, "WtimeNEW" is set to the resending time out value in a terminal unit C1 etc. Moreover, "WtimeOLD" is "WtimeNEW" computed last time, and initial value is "LBOUND." "WindowSIZENEW" is the window size of the current terminal unit C1, and "WindowSIZEOLD" is the window size of the last terminal unit C1. "LBOUND" is the lower limit of the waiting for transmission, "0", and "alpha" expresses the predetermined number for computing "WtimeNEW". [ for example, ]

[0066] After transmitting tmpACK to a transmitting agency, a setting change is made tmpACK transmitting ending (step S58), and the return of the information on the segment which has carried out the entry on all the distribution managed tables 1 corresponding to tmpACK which transmitted is carried out to step S13.

[0067] Below, with reference to the flow chart shown in drawing 8, the procedure of the confirmation-of-receipt processing by SG distribution Management Department 16 of data distribution management equipment 10 and the resending control processing by the result is explained. This confirmation-of-receipt processing and resending control processing are arranged in parallel with the check processing of a packet and tmpACK use control processing which were shown in drawing 2, and are processed.

[0068] In drawing 8, it judges whether the event which shows arrival of the confirmation-of-receipt response from a terminal unit C2 first was received (step S61). This event is an event generated in processing of the check of the packet in step S11. It judges whether when the confirmation-of-receipt response has arrived (steps S61 and YES), it is the notice of initiation from a terminal unit C2 (step S69), and this processing is ended when it is the notice of initiation (steps S69 and YES). On the other hand, when it is judged that it is not the notice of initiation from a terminal unit C2 (steps S61 and NO), the result which receives the data segment which the received confirmation-of-receipt response shows in the distribution managed table 1 is filled in (step S70). For example, in the communication link without the SACK option, as compared with the data segment which the confirmation-of-receipt response which is the waiting for ACK reception among the entries of the distribution managed table 1, and was received shows, a sequence number makes all the small data segments ACK receiving settled. On the other hand, in the communication link with a SACK option, as compared with the data segment which the confirmation-of-receipt response which is the waiting for ACK reception among the entries of the distribution managed table 1, and was received shows, a sequence number is a small data segment, and suppose finishing [ ACK reception of all the data segments that are not in the SACK option ].

[0069] A segment [ finishing / ACK reception / among the entries of the distribution managed table 1 ] is deleted from a transmission buffer 6 after processing of step S70 (step S71). The deletion of an ACK receiving segment has a timer about deletion, packs it for every fixed time amount, and you may make it delete it here.

[0070] On the other hand, when it is judged in step S61 that the event of the confirmation-of-receipt response reception from a terminal unit C2 is not received, it judges whether the resending time-out occurred further (step S62). When the resending time-out has not occurred (steps S62 and NO), this processing is ended as it is. On the other hand, when it is judged that the resending time-out occurred (steps S62 and YES), it judges whether transmission of tmpACK is suspended (step S63).

[0071] Data distribution management equipment 10 has the false window (thing imitating the window in a TCP communication link) united with the receive buffer 7 here. The amount which subtracted the daily dose which remains in the receive buffer 7 from this false window size, Namely, the total amount of the segment received from the transmitting agency is subtracted from a false window size. The amount adding the total amount of the segment to which the confirmation-of-receipt response from the destination is furthermore coming When the size for further 1 segment is exceeded rather than the window size of the transmitting origin which it grasps in data distribution management equipment 10, It judges that tmpACK is not stopped (steps S63 and NO), the temporary ACK creation halt flag shown in drawing 6 is set as "OFF",



processing which starts transmission of tmpACK is performed (step S64), and it shifts to step S66.

[0072] On the other hand, when [ that ] reverse, it judges that tmpACK is stopped (steps S63 and YES), and the temporary ACK creation halt flag shown in drawing 6 is set as "ON", processing which suspends transmission of tmpACK is performed (step S65), and it shifts to step S66. Here, decision whether tmpACK mentioned above is stopped is explained concretely. When magnitude of the "y" cutting tool and one segment to receive was made into the "k" cutting tool for the total amount of the segment which is in the "m" cutting tool and the current receive buffer 7 about the window size of the transmitting origin C1, i.e., a terminal unit, the transmitting "X" cutting tool and the transmitting data distribution management equipment 10 at this time grasp the false window size and a degree type (2) is materialized, a judgment which stops temporary ACK is made. namely, --  $X-y < m+k$  -- (2) --

It comes out.

[0073] Then, the retry count of the entry of the data segment which the time-out in the distribution managed table 1 generated is incremented, a resending flag "is set" (step S66), and it judges that it is distribution termination (step S67). When the time-out of resending is repeated, data distribution management equipment 10 carries out retry out of resending, when exchange of the data packet of the distribution termination in the usual TCP communication link is detected or and it ends distribution, it is judged as distribution termination (steps S67 and YES), a distribution post process is performed (step S68), and this processing is ended. In addition, the time out value of resending and the count of retry out need to be set up longer enough than the time out value and the count of retry out of resending in a terminal unit C1 and a terminal unit C2.

[0074] Processing of step S68 performs processing which changes with distribution exit status. When exchange of the data packet of the distribution termination in the usual TCP communication link is detected, in the tmpACK buffers 4, transmission buffers 6, and all the receive buffers 7, all the data segments in the communication link to end are deleted, and the entry of the distribution managed table 1 is also deleted. In addition, the entry of the distribution managed table 1 can also serve as and save are recording of data. Moreover, unless it prepares a life in an entry or an entry overflows, you may leave.

[0075] On the other hand, when it is judged in step S67 that it is not distribution termination, resending processing of steps S72-S74 is performed. That is, at step S72, the resending flag of the distribution managed table 1 resends the data segment of a transmission buffer 6 for what is turned "on", and "clears" the resending flag of the distribution managed table 1. A resend timer is reset after processing of this step S72 (step S73), the increment of the retry count counter of data distribution management equipment 10 is performed (step S74), and this processing is ended.

[0076] gestalt 2. of operation -- below, the gestalt 2 of implementation of this invention is explained. With the gestalt 2 of this operation, the delay [ processing / which was shown in drawing 6 / tmpACK use control ] according to a window size is added, and it is made to perform creation processing and transmitting processing of tmpACK.

[0077] Drawing 9 is a flow chart which shows the tmpACK use procedure of the data distribution management equipment which is the gestalt 2 of implementation of this invention. In drawing 9, it judges whether the data packet of communication link termination is receiving settled with reference to the value of the flag set up by a series of processings shown in drawing 2 received [ FIN ] (step S81). When finishing [ FIN packet reception ] is judged (steps S81 and YES), a return is carried out to step S13 as it is.

[0078] On the other hand, when finishing [ FIN packet reception ] is not judged (steps S81 and NO), it judges whether the flag which shows that the time delay for temporary ACK passed stands (step S82). When the time delay for temporary ACK has passed (steps S82 and YES), a delay temporary ACK timer and a related flag are reset (step S83).

[0079] An updating setup of the delay temporary ACK timer value according to a window size is carried out using [ at this time, for example, the correspondence table shown in drawing 10 , ]. For example, in drawing 10, when a window size is more than "5" kbyte, an updating setup of



the delay timer is carried out at "5" msec. Then, it shifts to step S84.

[0080] When it is judged in step S82 that the time delay for temporary ACK has not passed, it sets to data distribution management equipment 10. When it judges whether there are any non-transmitted data to a terminal unit C1 (step S86) and there are no non-transmitted data (steps S86 and NO), a return is carried out to step S13, and when there are non-transmitted data (steps S86 and YES), it shifts to step S87.

[0081] In step S87, it judges whether the data packet saved at the tmpACK buffer 4 is a packet (SYN+ACK), and when it is a packet (SYN+ACK), a non-transmitted packet (SYN+ACK) is transmitted to the destination (step S85), and a return is carried out to step S13.

[0082] On the other hand, when it is judged that the data packet saved at the tmpACK buffer 4 is not a packet (SYN+ACK) in step S87, it judges whether the data segment required for transmission of tmpACK is received (step S88). In processing of step S84 and step 88, it reaches [ whether the segment required for transmission of tmpACK was received and ] with reference to ON of the distribution managed table 1 and a temporary ACK creation flag, and OFF, and judges whether transmission of tmpACK is possible. That is, it judges whether tmpACK with delay is used. When decision whether the segment required for tmpACK transmission was received receives one or more segments of the sequence number after the segment X which is going to create tmpACK, creation of tmpACK to Segment X of it is enabled.

[0083] In step S84, when it is judged that tmpACK with delay is not used, the ACK packet which is not transmitted in the tmpACK buffer 4 is transmitted to a terminal unit C1 (step S85), and a return is carried out to step S13.

[0084] On the other hand, when it is judged in steps S84 and S88 that tmpACK with delay is used, the data segment from the terminal unit C1 set as the object of creation of tmpACK is determined (step S89). In processing of this step 89, it processes with reference to the SACK option of the receiving situation in data distribution management equipment 10, the window size of a transmitting agency, the transmitting situation of tmpACK, and the TCP protocol between a terminal unit C1 and a terminal unit C2 etc. using the distribution managed table 1.

[0085] For example, in the communication link without the SACK option, a sequence number determines a large thing as the 2nd as a candidate for tmpACK creation in the segment by which it is the waiting for ACK reception among the entries of the distribution managed table 1, tmpACK is not transmitted, and the segment with a small sequence number is received in all the data distribution management equipments 10 as compared with the self-sequence number.

[0086] Moreover, for example, in the communication link with a SACK option, it is tmpACK ready-for-sending ability. And it has not tmpACK transmitted and is the waiting for ACK reception. In the segment which the segment group which is not received [ in which a self-sequence number has the sequence number which continued among small segments ] has received in the data distribution management equipment 10 which is four or less A sequence number determines the segment in front of one as creation of tmpACK, and an object of transmission rather than the rearmost thing.

[0087] The data segment rewritten for the number which added "1" to the sequence number of the data segment for [ of tmpACK which determined the attainment Acknowledgement number of the data segment saved at the tmpACK buffer 4 in step S89 ] creation is created as tmpACK after processing of step S89. In the case of TCP with the SACK option, mounting which creates tmpACK which took the SACK option into consideration in step S89 is also possible. Then, in step S90, the confirmation-of-receipt response which also added the SACK option is created.

[0088] the information on the data segment which has carried out the entry on all the distribution managed tables 1 on which tmpACK is transmitted to a terminal unit C1 after processing of step S90 (step S91), and this tmpACK that transmitted corresponds — tmpACK transmission — finishing — a modification setup is carried out (step S92), and a return is carried out to step S13.

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[Translation done.]

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

[Drawing 1] It is the block diagram showing the configuration of the data distribution managerial system containing the data distribution management equipment which is the gestalt 1 of implementation of this invention.

[Drawing 2] It is the flow chart which shows the data distribution management procedure by the data distribution management equipment shown in drawing 1 .

[Drawing 3] It is the detail flowchart which shows the check procedure of a packet shown in drawing 2 .

[Drawing 4] It is drawing showing an example of the contents of the path managed table shown in drawing 1 .

[Drawing 5] It is drawing showing an example of the contents of the protocol managed table shown in drawing 1 .

[Drawing 6] It is drawing showing an example of the contents of the distribution managed table shown in drawing 1 .

[Drawing 7] It is the detail flowchart which shows the tmpACK use control procedure shown in drawing 2 .

[Drawing 8] It is the flow chart which shows the procedure of the confirmation-of-receipt processing and resending control processing by the data distribution management equipment shown in drawing 1 .

[Drawing 9] It is the detail flowchart which shows the tmpACK use control procedure by the data distribution management equipment which is the gestalt 2 of implementation of this invention.

[Drawing 10] It is drawing showing an example of the correspondence table showing the correspondence relation between the window size which the data distribution management equipment shown in drawing 9 has, and the set point of a delay timer.

[Drawing 11] It is the block diagram showing the configuration of the data distribution managerial system containing conventional data distribution management equipment.

**[Description of Notations]**

1 A distribution managed table, the 1a communications department, the 12 tmpACK use judging section, the 13 tmpACK creation section, a 14 SGTimer count area, 15 distribution data-logging section, the 16 SG distribution Management Department, C1, C2 terminal unit. A path managed table, 2a, 2b, 3 A circuit, 4tmpACK buffer, 5 A protocol managed table, 6 10 A transmission buffer, 7 receive buffers, 20 Data distribution management equipment, 10a 11 A gateway function part, 17

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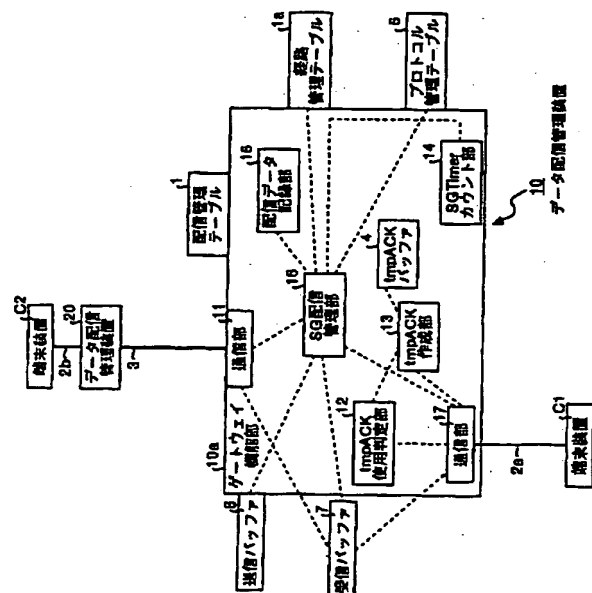
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(54) 【発明の名称】 データ配信管理装置

(57) 【要約】

【課題】 送受信バッファ、ウィンドウサイズおよび回線の輻輳などの状態を考慮し、仮の送達確認応答の送信タイミングあるいは送信量を調整し、一層高速かつ効率的にデータ配信を行うこと。

【解決手段】 データ配信管理装置10は、端末装置C1のウィンドウサイズの情報を持する配信管理テーブル1と、配信管理テーブル1が保持するウィンドウサイズをもとに仮の送達確認応答の返送処理を行わせない制御を行うSG配信管理部16とを備え、送信元のウィンドウサイズに応じて、仮の送達確認応答を作成し、返送するかを決定し、あるいは仮の送達確認応答の送信タイミングを調節する。



## 【特許請求の範囲】

【請求項 1】 送信したデータに対する送達確認応答を必要とする通信を行う第 1 の端末装置と該第 1 の端末装置の通信相手先である第 2 の端末装置との間の伝送路上に配置され、前記第 1 の端末装置との間の伝送遅延が前記第 2 の端末装置との間の伝送遅延に比して小さく、少なくとも前記第 1 の端末装置からのデータを前記第 2 の端末装置に対して転送する転送処理と該転送したデータに対する送達確認応答を作成し返送する返送処理とを行うことができるデータ配信管理装置において、

前記第 1 の端末装置のウィンドウサイズの情報を保持する保持手段と、

前記保持手段が保持するウィンドウサイズの情報をもとに前記送達確認応答の返送処理を行うか否かを決定する決定手段と、

前記決定手段が前記送達確認応答の返送処理を行うと決定した場合に前記送達確認応答の返送処理を行う制御手段と、

を備えたことを特徴とするデータ配信管理装置。

【請求項 2】 送信したデータに対する送達確認応答を必要とする通信を行う第 1 の端末装置と該第 1 の端末装置の通信相手先である第 2 の端末装置との間の伝送路上に配置され、前記第 1 の端末装置との間の伝送遅延が前記第 2 の端末装置との間の伝送遅延に比して小さく、少なくとも前記第 1 の端末装置からのデータを前記第 2 の端末装置に対して転送する転送処理と該転送したデータに対する送達確認応答を作成し返送する返送処理とを行うことができるデータ配信管理装置において、

前記第 1 の端末装置のウィンドウサイズの情報を保持する保持手段と、

前記保持手段が保持するウィンドウサイズの情報が示すウィンドウサイズに応じて前記第 1 の端末装置が送信したデータに対する前記送達確認応答の返送タイミングを可変させる制御を行う制御手段と、

を備えたことを特徴とするデータ配信管理装置。

【請求項 3】 前記第 2 の端末装置から受信した送達確認応答の受信時点から前記第 1 の端末装置に送達確認応答を返送する返送時点までの遅延時間に略対応した所定の下限値を初期値とする現在の遅延時間から、前記第 1 の端末装置における現在のウィンドウサイズから前回のウィンドウサイズを減算した第 1 の減算値に所定値を乗算した第 2 の値を減算した第 2 の減算値と、前記所定の下限値との最大値を算出し、該最大値と所定の上限値との最小値とを算出し、該最小値を前記現在の遅延時間として再設定する処理を繰り返して最新の現在の遅延時間を算出する算出手段をさらに備え、

前記制御手段は、前記算出手段によって算出された最新の現在の遅延時間に応じて前記第 1 の端末装置が送信したデータに対する前記送達確認応答の返送タイミングを可変させる制御を行うことを特徴とする請求項 2 に記載

のデータ配信管理装置。

【請求項 4】 送信したデータに対する送達確認応答を必要とする通信を行う第 1 の端末装置と該第 1 の端末装置の通信相手先である第 2 の端末装置との間の伝送路上に配置され、前記第 1 の端末装置との間の伝送遅延が前記第 2 の端末装置との間の伝送遅延に比して小さく、少なくとも前記第 1 の端末装置からのデータを前記第 2 の端末装置に対して転送する転送処理と該転送したデータに対する送達確認応答を作成し返送する返送処理とを行うことができるデータ配信管理装置において、

前記第 1 の端末装置のウィンドウサイズと前記第 1 の端末装置から受信したデータのセグメント数と前記第 2 の端末装置からの受信確認応答の有無とを少なくとも保持する保持手段と、

前記保持手段が保持する前記ウィンドウサイズと前記セグメント数と前記受信確認応答の有無との組み合わせによって前記第 1 の端末装置が送信したデータに対する前記送達確認応答の返送を行うか否かを決定する決定手段と、

前記決定手段が前記送達確認応答の返送を行うと決定した場合に該送達確認応答の返送を行う制御手段と、

を備えたことを特徴とするデータ配信管理装置。

【請求項 5】 送信したデータに対する送達確認応答を必要とする通信を行う第 1 の端末装置と該第 1 の端末装置の通信相手先である第 2 の端末装置との間の伝送路上に配置され、前記第 1 の端末装置との間の伝送遅延が前記第 2 の端末装置との間の伝送遅延に比して小さく、少なくとも前記第 1 の端末装置からのデータを前記第 2 の端末装置に対して転送する転送処理と該転送したデータに対する送達確認応答を作成し返送する返送処理とを行うことができるデータ配信管理装置において、

前記第 1 の端末装置のウィンドウサイズの情報を保持する保持手段と、

前記保持手段が保持するウィンドウサイズの情報が示すウィンドウサイズに応じて前記第 1 の端末装置が送信したデータに対する前記送達確認応答の作成密度を可変させる制御を行う制御手段と、

を備えたことを特徴とするデータ配信管理装置。

【請求項 6】 少なくとも前記第 1 の端末装置が送信したデータを保持するデータバッファと、

少なくとも前記第 1 の端末装置が送信したデータの登録情報を管理する管理手段と、

前記第 1 の端末装置が送信したデータを転送した前記第 2 の端末装置から該データに対する送達確認応答を受信した場合、前記データバッファに保持されている該データおよび前記管理手段が管理する該データの登録情報を削除する制御を行う削除制御手段と、

をさらに備えたことを特徴とする請求項 1～5 のいずれか一つに記載のデータ配信管理装置。

【請求項 7】 前記データバッファ内に保持されたデー

タのうちの削除対象のデータである送達確認済みのセグメント数を計数する計数手段をさらに備え、

前記削除制御手段は、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに登録情報を送達確認済みに設定し、前記計数手段が計数する該送達確認済みに設定されたセグメント数が所定数を越えた場合に、前記データバッファに保持されている該送達確認済みのデータと前記管理手段が管理する該送達確認済みのデータの登録情報を削除すること

を特徴とする請求項6に記載のデータ配信管理装置。  
 【請求項8】 前記データバッファ内に保持されたデータのうちの削除対象のデータである送達確認済みのセグメント数を計数する第1の計数手段と、  
 前記管理手段が管理するデータのうちの削除対象のデータの登録情報を計数する第2の計数手段と、  
 をさらに備え、

前記削除制御手段は、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに関する情報を送達確認済みに設定し、前記第1の計数手段が計数する送達確認済みに設定されたセグメント数が第1の所定数を越えた場合に、前記データバッファに保持されている該送達確認済みのデータを削除し、前記第2の計数手段が計数する送達確認済みのデータの登録情報が第2の所定数を越えた場合に、該送達確認済みのデータの登録情報を削除すること

を特徴とする請求項6に記載のデータ配信管理装置。  
 【請求項9】 所定時間を計時する計時手段をさらに備え、

前記削除制御手段は、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに登録情報を送達確認済みに設定し、前記計時手段が前記所定時間を計時した際に、前記データバッファに保持されている該送達確認済みのデータと前記管理手段が管理する該送達確認済みのデータの登録情報を削除すること

を特徴とする請求項6に記載のデータ配信管理装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、送信したデータに対する送達確認応答を必要とする通信を行う第1の端末装置と該第1の端末装置の通信相手先である第2の端末装置との間の伝送路上に配置され、前記第1の端末装置との間の伝送遅延が前記第2の端末装置との間の伝送遅延に比して小さく、少なくとも前記第1の端末装置からのデータを前記第2の端末装置に対して転送する転送処理と該転送したデータに対する送達確認応答を作成し返送する返送処理とを行うことができるデータ配信管理

装置に関し、特にデータ配信時における送達確認応答の受信タイミングに依存した速度性能劣化を改善することができるデータ配信管理装置に関するものである。

【0002】

【従来の技術】従来から、TCPを用いた通信では、送信側のTCPは、送信バッファに対応したウィンドウサイズを持ち、このウィンドウサイズ内に限り、送信ウィンドウをスライドさせることによって、次々とデータ送信を行う。仮に、なんらかの理由によって送達確認応答を受け入れていない状況となった場合、TCPは、輻輳状態であると判断し、ウィンドウサイズを小さくし、これによってスループットを下げ、輻輳を解消しようとする。

【0003】しかし、衛星回線のような大容量であるとともに、物理的に伝送遅延の大きな回線においてTCPを用いた場合、物理的な距離によって、データ送信からこのデータに対する送達確認応答が返ってくるまでに0.5秒以上を要する場合がある。この0.5秒は、一般的なTCPにおける再送タイムアウト時間、すなわちデータ送信を失敗と判断し、データ再送を開始するまでの時間であり、TCPが、輻輳状態が生じていると判断してしまう時間である。この結果、衛星回線のように大容量の回線本来の大きさに見合った速度性能、すなわちスループットを発揮することができないという問題点が生じる。

【0004】図11は、従来のデータ配信管理装置を用いたデータ配信管理システムの構成を示すブロック図である（情報処理学会研究報告98-DPS-89-12参照）。このデータ配信管理システムは、上述した問題点を解決し、スループットを向上させることができるシステムである。図11において、このデータ配信管理システムは、送信装置C11と、受信装置C12と、この送信装置C11および受信装置C12にTCPによる通信を行う回線L11、L12を介してそれぞれ接続された送信ゲートウェイ100とを有する。回線L12は、回線L11に比して伝送遅延が大きい回線であり、たとえば衛星回線である。

【0005】図11において、送信装置C11は、データパケットを出力するデータパケット出力部111と、送信ゲートウェイ100が作成した仮の到達確認応答を受信する仮送達確認応答受信部112とを有する。送信ゲートウェイ100は、バッファ101および配信管理テーブル102を有するとともに、送信装置C11から送信されたデータパケットを受信し、このデータパケットをバッファ101に蓄積させる蓄積部103と、回線L12を介してバッファ101に蓄積したデータデータパケットを受信装置C12に出力する出力部104と、受信装置C12に送信したデータパケットに対する仮の送達確認応答を作成する仮送達確認応答作成部105と、この作成した仮の送達確認応答を送信装置C11に

送信する仮送達確認応答送信部106と、受信装置C12から送られた送達確認応答を受信する仮送達確認応答受信部107と、受信したSYN(接続要求)パケットから通信情報を取得し、配信管理テーブル102に配信情報として記録する配信情報記憶制御部108と、データパケットの再送処理を行う再送処理部109とを有する。また、受信装置C12は、送信ゲートウェイ100から送られたデータパケットを受信するデータパケット受信部1-2-1と、送信ゲートウェイ100に対して送達確認応答を出力する送達確認応答出力部122とを有する。

【0006】送信装置C11からデータパケットが送出されると、送信ゲートウェイ100は、受信したデータパケットをバッファ101に一時的に蓄積するとともに、配信管理テーブル102に、このデータパケットのエントリを追加する。送信ゲートウェイ100は、送信装置C11から受信したデータパケットを、回線L12を介して受信装置C12に転送するとともに、このデータパケットに対する仮の到達確認応答のデータパケットを作成し、送信装置C11にこの仮の到達確認応答を送信する。

【0007】受信装置C12は、送信ゲートウェイ100からデータパケットを受信すると、この受信データパケットに対する送達確認応答を作成し、この送達確認応答を送信ゲートウェイ100に送信する。この送達確認応答には、対応するデータパケットに関するデータとこのデータパケットの到達確認状況に関するデータとが含まれる。受信装置C12から送達確認応答を受信した送信ゲートウェイ100は、送信ゲートウェイ100内に保持されているデータパケットであって、この送達確認応答に対応するデータパケットをクリアする。

【0008】ここで、送信ゲートウェイ100から受信装置C12にデータパケットが送信される過程において、このデータパケットの転送に失敗し、受信装置C12がこのデータパケットを受信することができなかった場合、送信ゲートウェイ100は、受信装置C12側から同一の送達確認応答を3つ続けて受信し、このデータパケットの再送処理を行う。

【0009】このように、従来のデータ配信管理システムでは、送信ゲートウェイ100が、送信ゲートウェイ100から受信装置C12に対するデータパケットの送信と同時に、送信装置C11に対して仮の送達確認応答(tmpACK)を返送することによって、回線L12の伝送遅延によるTCPのウィンドウサイズの減少を防ぎ、スループットの低下をなくして速度性能の劣化を改善していた。

【0010】また、送信ゲートウェイ100は、送信装置からデータパケットを受信すると、仮の送達確認応答を作成し、受信装置からの送達確認応答(ACK)を受け付けるまで、このデータパケットを保持し、3つの同

一の送達確認応答(DuplicateACK)を受信した時点で、このデータパケットの送信を失敗と判定し、この保持しているデータパケットの再送を行うようにしていた。

【0011】

【発明が解決しようとする課題】しかしながら、従来のデータ配信管理システムでは、送信装置C11からデータセグメントを受信すると、送信ゲートウェイ100が、送信装置C11の送受信バッファあるいはウィンドウの状態、さらには回線L11の輻輳状態を考慮せずに、直ちに全てのデータセグメントに対する仮の送達確認応答を作成し、送信装置C11に対して送信するようにしていたため、送信ゲートウェイ100および送信装置C11の処理負荷が大きくなり、結果として速度性能が劣化する場合が生じるという問題点があった。

【0012】また、受信装置C12から送信された送達確認応答を含むデータは、受信装置C12が把握している送信装置C11の受信ウィンドウの状態に応じて決定されたスループットで送信されるが、送信ゲートウェイ100においてデータが受信された時点では、前回の古いウィンドウサイズに基づいたスループットでデータ転送を行っていたため、送信装置C11の受信バッファあるいは受信ウィンドウが減少していた場合、送信装置C11の更新された受信バッファあるいは受信ウィンドウの状態に対応できず、送信装置C11の受信バッファおよびウィンドウがオーバーフローを引き起こしてしまう場合があるという問題点があった。

【0013】この発明は、上記に鑑みてなされたもので、送受信バッファ、ウィンドウサイズおよび回線の輻輳などの状態を考慮し、仮の送達確認応答の送信タイミングあるいは送信量を調整し、一層高速かつ効率的にデータ配信を行うことができるデータ配信管理装置を得ることを目的とする。

【0014】

【課題を解決するための手段】上記目的を達成するため、この発明にかかるデータ配信管理装置は、送信したデータに対する送達確認応答を必要とする通信を行う第1の端末装置と該第1の端末装置の通信相手先である第2の端末装置との間の伝送路上に配置され、前記第1の端末装置との間の伝送遅延が前記第2の端末装置との間の伝送遅延に比して小さく、少なくとも前記第1の端末装置からのデータを前記第2の端末装置に対して転送する転送処理と該転送したデータに対する送達確認応答を作成し返送する返送処理とを行うことができるデータ配信管理装置において、前記第1の端末装置のウィンドウサイズの情報を保持する保持手段と、前記保持手段が保持するウィンドウサイズの情報をもとに前記送達確認応答の返送処理を行うか否かを決定する決定手段と、前記決定手段が前記送達確認応答の返送処理を行うと決定した場合に前記送達確認応答の返送処理を行う制御手段と

を備えたことを特徴とする。

【0015】この発明によれば、保持手段が、前記第1の端末装置のウィンドウサイズの情報を保持し、決定手段が、前記保持手段が保持するウィンドウサイズの情報をもとに前記送達確認応答の返送処理を行うか否かを決定し、制御手段が、前記決定手段が前記送達確認応答の返送処理を行うと決定した場合のみに前記送達確認応答の返送処理を行うようにし、送信元に対する送達確認応答の送信タイミングあるいは送信量を調整するようにしている。

【0016】つぎの発明にかかるデータ配信管理装置は、送信したデータに対する送達確認応答を必要とする通信を行う第1の端末装置と該第1の端末装置の通信相手先である第2の端末装置との間の伝送路上に配置され、前記第1の端末装置との間の伝送遅延が前記第2の端末装置との間の伝送遅延に比して小さく、少なくとも前記第1の端末装置からのデータを前記第2の端末装置に対して転送する転送処理と該転送したデータに対する送達確認応答を作成し返送する返送処理とを行うことができるデータ配信管理装置において、前記第1の端末装置のウィンドウサイズの情報を保持する保持手段と、前記保持手段が保持するウィンドウサイズの情報が示すウィンドウサイズに応じて前記第1の端末装置が送信したデータに対する前記送達確認応答の返送タイミングを可変させる制御を行う制御手段とを備えたことを特徴とする。

【0017】この発明によれば、保持手段が、前記第1の端末装置のウィンドウサイズの情報を保持し、制御手段が、前記保持手段が保持するウィンドウサイズの情報が示すウィンドウサイズに応じて前記第1の端末装置が送信したデータに対する前記送達確認応答の返送タイミングを可変させる制御を行うようにしている。

【0018】つぎの発明にかかるデータ配信管理装置は、上記の発明において、前記第2の端末装置から受信した送達確認応答の受信時点から前記第1の端末装置に送達確認応答を返送する返送時点までの遅延時間に略対応した所定の下限値を初期値とする現在の遅延時間から、前記第1の端末装置における現在のウィンドウサイズから前回のウィンドウサイズを減算した第1の減算値に所定値を乗算した第2の値を減算した第2の減算値と、前記所定の下限値との最大値を算出し、該最大値と所定の上限値との最小値とを算出し、該最小値を前記現在の遅延時間として再設定する処理を繰り返して最新の現在の遅延時間を算出する算出手段をさらに備え、前記制御手段は、前記算出手段によって算出された最新の現在の遅延時間に応じて前記第1の端末装置が送信したデータに対する前記送達確認応答の返送タイミングを可変させる制御を行うことを特徴とする。

【0019】この発明によれば、算出手段が、前記第2の端末装置から受信した送達確認応答の受信時点から前

記第1の端末装置に送達確認応答を返送する返送時点までの遅延時間に略対応した所定の下限値を初期値とする現在の遅延時間から、前記第1の端末装置における現在のウィンドウサイズから前回のウィンドウサイズを減算した第1の減算値に所定値を乗算した第2の値を減算した第2の減算値と、前記所定の下限値との最大値を算出し、該最大値と所定の上限値との最小値とを算出し、該最小値を前記現在の遅延時間として再設定する処理を繰り返して最新の現在の遅延時間を算出し、前記制御手段が、前記算出手段によって算出された最新の現在の遅延時間に応じて前記第1の端末装置が送信したデータに対する前記送達確認応答の返送タイミングを可変させる制御を行うようにしている。

【0020】つぎの発明にかかるデータ配信管理装置は、送信したデータに対する送達確認応答を必要とする通信を行う第1の端末装置と該第1の端末装置の通信相手先である第2の端末装置との間の伝送路上に配置され、前記第1の端末装置との間の伝送遅延が前記第2の端末装置との間の伝送遅延に比して小さく、少なくとも前記第1の端末装置からのデータを前記第2の端末装置に対して転送する転送処理と該転送したデータに対する送達確認応答を作成し返送する返送処理とを行うことができるデータ配信管理装置において、前記第1の端末装置のウィンドウサイズと前記第1の端末装置から受信したデータのセグメント数と前記第2の端末装置からの受信確認応答の有無とを少なくとも保持する保持手段と、前記保持手段が保持する前記ウィンドウサイズと前記セグメント数と前記受信確認応答の有無との組み合わせによって前記第1の端末装置が送信したデータに対する前記送達確認応答の返送を行うか否かを決定する決定手段と、前記決定手段が前記送達確認応答の返送を行うと決定した場合に該送達確認応答の返送を行う制御手段とを備えたことを特徴とする。

【0021】この発明によれば、保持手段が、前記第1の端末装置のウィンドウサイズと前記第1の端末装置から受信したデータのセグメント数と前記第2の端末装置からの受信確認応答の有無とを少なくとも保持し、決定手段が、前記保持手段が保持する前記ウィンドウサイズと前記セグメント数と前記受信確認応答の有無との組み合わせによって前記第1の端末装置が送信したデータに対する前記送達確認応答の返送を行うか否かを決定し、制御手段が、前記決定手段が前記送達確認応答の返送を行うと決定した場合に該送達確認応答の返送を行うようにしている。

【0022】つぎの発明にかかるデータ配信管理装置は、送信したデータに対する送達確認応答を必要とする通信を行う第1の端末装置と該第1の端末装置の通信相手先である第2の端末装置との間の伝送路上に配置され、前記第1の端末装置との間の伝送遅延が前記第2の端末装置との間の伝送遅延に比して小さく、少なくとも

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前記第1の端末装置からのデータを前記第2の端末装置に対して転送する転送処理と該転送したデータに対する送達確認応答を作成し返送する返送処理とを行うことができるデータ配信管理装置において、前記第1の端末装置のウィンドウサイズの情報を保持する保持手段と、前記保持手段が保持するウィンドウサイズの情報が示すウィンドウサイズに応じて前記第1の端末装置が送信したデータに対する前記送達確認応答の作成密度を可変させる制御を行う制御手段とを備えたことを特徴とする。

【0023】この発明によれば、保持手段が、前記第1の端末装置のウィンドウサイズの情報を保持し、制御手段が、前記保持手段が保持するウィンドウサイズの情報が示すウィンドウサイズに応じて前記第1の端末装置が送信したデータに対する前記送達確認応答の作成密度を可変、たとえば送達確認応答を間引く制御を行うようにしている。

【0024】つぎの発明にかかるデータ配信管理装置は、上記の発明において、少なくとも前記第1の端末装置が送信したデータを保持するデータバッファと、少なくとも前記第1の端末装置が送信したデータの登録情報を管理する管理手段と、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答を受信した場合、前記データバッファに保持されている該データおよび前記管理手段が管理する該データの登録情報を削除する制御を行う削除制御手段とをさらに備えたことを特徴とする。

【0025】この発明によれば、データバッファが、少なくとも前記第1の端末装置が送信したデータを保持し、管理手段が、少なくとも前記第1の端末装置が送信したデータの登録情報を管理し、削除制御手段が、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答を受信した場合、前記データバッファに保持されている該データおよび前記管理手段が管理する該データの登録情報を削除する制御を行うようにしている。

【0026】つぎの発明にかかるデータ配信管理装置は、上記の発明において、前記データバッファ内に保持されたデータのうちの削除対象のデータである送達確認済みのセグメント数を計数する計数手段をさらに備え、前記削除制御手段は、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに登録情報を送達確認済みに設定し、前記計数手段が計数する該送達確認済みに設定されたセグメント数が所定数を越えた場合に、前記データバッファに保持されている該送達確認済みのデータと前記管理手段が管理する該送達確認済みのデータの登録情報を削除することを特徴とする。

【0027】この発明によれば、計数手段が、前記データバッファ内に保持されたデータのうちの削除対象のデ

ータである送達確認済みのセグメント数を計数し、前記削除制御手段が、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに登録情報を送達確認済みに設定し、前記計数手段が計数する該送達確認済みに設定されたセグメント数が所定数を越えた場合に、前記データバッファに保持されている該送達確認済みのデータと前記管理手段が管理する該送達確認済みのデータの登録情報を削除するようにしている。

【0028】つぎの発明にかかるデータ配信管理装置は、上記の発明において、前記データバッファ内に保持されたデータのうちの削除対象のデータである送達確認済みのセグメント数を計数する第1の計数手段と、前記管理手段が管理するデータのうちの削除対象のデータの登録情報を計数する第2の計数手段とをさらに備え、前記削除制御手段は、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに関する情報を送達確認済みに設定し、前記第1の計数手段が計数する送達確認済みに設定されたセグメント数が第1の所定数を越えた場合に、前記データバッファに保持されている該送達確認済みのデータを削除し、前記第2の計数手段が計数する送達確認済みのデータの登録情報が第2の所定数を越えた場合に、該送達確認済みのデータの登録情報を削除することを特徴とする。

【0029】この発明によれば、第1の計数手段が、前記データバッファ内に保持されたデータのうちの削除対象のデータである送達確認済みのセグメント数を計数し、第2の計数手段が、前記管理手段が管理するデータのうちの削除対象のデータの登録情報を計数し、前記削除制御手段が、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに関する情報を送達確認済みに設定し、前記第1の計数手段が計数する送達確認済みに設定されたセグメント数が第1の所定数を越えた場合に、前記データバッファに保持されている該送達確認済みのデータを削除し、前記第2の計数手段が計数する送達確認済みのデータの登録情報が第2の所定数を越えた場合に、該送達確認済みのデータの登録情報を削除するようにしている。

【0030】つぎの発明にかかるデータ配信管理装置は、上記の発明において、所定時間を計時する計時手段をさらに備え、前記削除制御手段は、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに登録情報を送達確認済みに設定し、前記計時手段が前記所定時間を計時した際に、前記データバッファに保持されている該送達確認済みのデ



ータと前記管理手段が管理する該送達確認済みのデータの登録情報を削除することを特徴とする。

【0031】この発明によれば、計時手段が、所定時間を計時する計時手段をさらに備え、前記削除制御手段が、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに登録情報を送達確認済みに設定し、計時手段が前記所定時間を計時した際に、前記データバッファに保持されている該送達確認済みのデータと前記管理手段が管理する該送達確認済みのデータの登録情報を削除するようにしている。

【0032】

【発明の実施の形態】以下、添付図面を参照して、この発明にかかるデータ配信管理装置の好適な実施の形態を詳細に説明する。

【0033】実施の形態1. 図1は、この発明の実施の形態1であるデータ配信管理装置を含むデータ配信管理システムの構成を示すブロック図である。図1において、このデータ配信管理システムは、端末装置C1が回線2aを介してデータ配信管理装置10に接続され、データ配信管理装置10が回線3を介してデータ配信管理装置20に接続され、データ配信管理装置20が回線2bを介して端末装置C2に接続される。回線3は、衛星回線などの伝送遅延の大きな回線であり、回線2a、2bは、回線3に比して伝送遅延が小さい回線である。

【0034】データ配信管理装置10は、ゲートウェイ機能部10aと、配信管理テーブル1と、プロトコル管理テーブル5と、送信バッファ6、および受信バッファ7とを有する。ゲートウェイSGは、端末装置C1との間においてデータパケットの入出力処理を行う通信部17と、データ配信管理装置20を介した端末装置C2との間においてデータパケットの入出力処理を行う通信部11と、仮の送達確認応答(tmpACK)を作成するためのデータパケットを保存するtmpACKバッファ4と、端末装置C2に対して送信したデータパケットに対してtmpACKの返送を行うか否かを判断するtmpACK使用判定部12、端末装置C1から受信したデータパケットをもとにtmpACKを作成するtmpACK作成部13と、データパケット毎の送達確認応答のタイムアウト時間(SGTimer)をカウントアップし、この送達確認応答待ちのタイムアウトイベントを発生させるSGTimerカウント部14と、端末装置C1にtmpACKを送信したか否かの情報および端末装置C2からの送達確認応答に関する情報を配信管理テーブル1に書き込む処理を行う配信データ記録部15と、SGTimer値および配信管理テーブル1の内容に対応してデータパケットの配信を管理するSG配信管理部16とを有する。

【0035】なお、図1において、送信バッファ6、受

信バッファ7、およびtmpACKバッファ4は、それぞれ別個のバッファとして示されているが、これに限らず、部分的あるいは全てを同一のバッファとして実装するようにしてもよい。また、別個のバッファとして実装する場合であっても、同一のバッファとして実装する場合であっても、管理目的に応じて制御情報などを含めた情報とともに用いることが可能な図示しない管理テーブルを設け、パケットデータの格納位置が識別可能なように実装することによって、管理および検索の効率化を図ることができる。

【0036】データ配信管理装置20は、データ配信管理装置10と同じ構成を有する。データ配信管理装置10は、端末装置C1から送信されたデータパケットをデータ配信管理装置20を介して端末装置C2に転送する。この際、データ配信管理装置10は、tmpACK使用判定部12において端末装置C1から受信したデータパケットに対し、tmpACKの返送機能を適用するか否かを判定し、適用すると判定された場合、端末装置C1に、送信されたデータパケットに対する仮の到達確認応答(tmpACK)を返送し、データ配信管理装置20は、通常のゲートウェイと同様に、データ配信管理装置10から送られたデータパケットを端末装置C2に転送するルーティング処理のみを行い、tmpACKの返送処理は行わない。また、データ配信管理装置20は、端末装置C2から送信されたデータパケットをデータ配信管理装置10を介して端末装置C1に転送する。この際、データ配信管理装置20は、tmpACK使用判定部12において端末装置C2から受信したデータパケットに対し、tmpACKの返送機能を適用するか否かを判定し、適用すると判定された場合、端末装置C2に、送信されたデータパケットに対するtmpACKを返送し、データ配信管理装置10は、通常のゲートウェイと同様に、データ配信管理装置20から送られたデータパケットを端末装置C1に転送するルーティング処理のみを行い、tmpACKの返送処理は行わない。これによって、端末装置C1、C2間の双方向通信が実現される。なお、以下の説明では、端末装置C1が送信側端末とし、端末装置C2が受信側端末とし、データ配信管理装置10の動作処理について説明するが、端末装置C2が送信側端末とし、端末装置C1が受信側端末した場合におけるデータ配信管理装置20の動作処理は、データ配信管理装置10と同じである。

【0037】ここで、図2～図8を参照して、データ配信管理装置10のデータ配信管理処理について説明する。まず、ゲートウェイSGの通信部17、11は、データパケットを受信すると、この受信したデータパケットを受信バッファ7に一時保存し、SG配信管理部16は、図2に示す配信処理を行う。

【0038】図2において、まず、tmpACK使用判定部12が、受信したデータパケットのチェックを行

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い、このチェック結果に応じてデータ配信管理装置10がもつ受信データパケットに対するtmpACK利用可能フラグの「ON」、「OFF」を決定し、必要に応じてtmpACK利用可能フラグの「ON」、「OFF」も含め、受信データパケットの情報を配信管理テーブルに登録する(ステップS11)。

【0039】その後、tmpACK制御フラグをもとにtmpACKの利用制御を行うか否かを判断する(ステップS12)。tmpACKの利用制御を行わない場合(ステップS12、NO)には、そのまま本処理を終了し、tmpACKの利用制御を行う場合(ステップS12、YES)には、tmpACK利用制御処理を実行して(ステップS13)、本処理を終了する。

【0040】図3は、図2に示したステップS11におけるパケットのチェック処理手順を示すフローチャートである。図3において、まず、データ配信管理装置10は、受信したデータパケットのIPアドレスが正しいIPアドレスであり、かつ受信したデータパケットの送信先が、遅延の大きな回線を介した転送であるか否かを経路管理テーブル1aを用いて判断する(ステップS21)。このステップS21では、ネットワーク層のヘッダがIPヘッダであるか否かを確認し、その後、ルーティング機能によって決定される経路上に伝送遅延回線が存在するか否かを配信管理テーブル1を用いて判断する。プロトコルがIPを用いていない場合、正しいフォーマットのアドレスでない場合、さらに宛先までの経路上に伝送遅延回線が存在しない場合(ステップS21、NO)には、tmpACK利用可能フラグを「OFF」に設定し(ステップS22)、受信したデータパケットを宛先に転送し(ステップS23)、ステップS11にリターンする。なお、このtmpACK利用可能フラグは、上述した別個のバッファあるいは同一のバッファに設けられる図示しない管理テーブルを用いる場合、この管理テーブル内の情報として保持するようにしてもよい。

【0041】ここで、図4は、経路管理テーブル1aの内容を示す図である。図4において、この経路管理テーブル1aには、宛先IP毎に、宛先までの経路が管理され、各経路毎に遅延の有無が記述されている。たとえば、宛先IPが「10.74.3.200」の場合、経路「1」～「4」の4つの経路がリストアップされているが、経路「1」の経路は、遅延がある経路となる。したがって、経路「1」が選択された場合に、遅延依存の回線に対する転送であると判断される。

【0042】その後、受信したデータパケットのIPアドレスが正しく、かつ宛先までの経路に伝送遅延が存在する場合(ステップS21、YES)、tmpACK使用判定部12は、プロトコル管理テーブル5を用いて、IPヘッダのプロトコルが遅延依存であるか否かを判断する(ステップS24)。IPヘッダのプロトコルが遅延

依存である場合(ステップS24、YES)には、さらにTCPヘッダの送信ポートが遅延依存であるか否かを判断する(ステップS25)。IPヘッダのプロトコルが遅延依存でない場合(ステップS24、NO)およびTCPヘッダの送信ポートが遅延依存でない場合(ステップS25、NO)には、tmpACK利用可能フラグを「OFF」に設定し(ステップS22)、さらに受信したデータパケットを宛先に転送し(ステップS23)、ステップS11にリターンする。

【0043】ここで、図5は、tmpACK使用判定部12が用いるプロトコル管理テーブル5内の判定テーブルの一例を示す図である。図5において、参照ヘッダの項目D1は、判定対象のデータパケットの判定に用いるヘッダ部を示している。また、プロトコル名の項目D2は、参照ヘッダの項目D1で指定したヘッダ部にあるデータのプロトコルの種別項目を示している。さらに、スプーフィング使用可否の項目D3は、tmpACKの返送処理を用いるべきプロトコルであるか否かを示す情報を表している。この判定テーブルをもとにしたステップS24、S25の具体的な判断処理について説明すると、まず、ステップS24において、tmpACK使用判定部12は、受信したデータパケットのIPヘッダのプロトコルを示すバイト列を参照し、TCPのデータを受信したと判定された場合、ステップS25において、TCPヘッダ部の送信元ポート番号を参照し、BGPでないと判定された場合に、tmpACKの返送処理を利用できると判断できる。一方、BGPのデータを受信した場合は、tmpACKの返送処理を利用できないと判断できる。

【0044】また、ステップS24において、IPヘッダのプロトコル部にある上位プロトコルがデータ配信管理装置10において遅延依存のプロトコルではないとされた場合(ステップS24、NO)、上述したようにtmpACK利用可能フラグを「OFF」にし(ステップS22)、受信したデータパケットを宛先に転送し(ステップS23)、ステップS11にリターンする。一方、ステップS24において、上位プロトコルが遅延依存のプロトコルであると判断され、ステップS25において、TCPヘッダの送信元ポート番号をもとに、遅延依存のプロトコルではないとされた場合も、上述したようにtmpACK利用可能フラグを「OFF」にし(ステップS22)、受信したデータパケットを宛先に転送し(ステップS23)、ステップS11にリターンする。

【0045】さて、ステップS24、S25において、遅延依存のプロトコルであると判断された場合には、受信したデータパケットのヘッダ部のコードビットの値を参照し、通信開始時のデータパケットであるか否かを判断する(ステップS26)。図示しない開始時パケットバッファとして専用のバッファを設ける。あるいは、受

信バッファ7および送信バッファ6などのバッファを用いて、図示しない開始時バケットバッファとしてもよい。なお、図示しない開始時バケットバッファに保存するデータバケットを、送信装置毎、受信装置毎、通信する送信装置および受信装置の組み合わせ毎、通信する装置および通信ポートが同一のものを一つの通信として定義した場合における通信毎、あるいは通信の種類毎にタグを付けて管理するようにしてもよい。

—【0046】通信開始時のデータバケットでない場合（ステップS26、NO）には、受信したデータバケットが、配信管理テーブル1に既に登録済の通信であるか否かの判断を行う（ステップS27）。このステップS27では、IPヘッダ中の送信元IPとTCPヘッダ中の送信元ポートとの組み合わせおよび宛先IPと宛先ポートとの組み合わせが全て同一の通信を同一の管理単位とし、登録済の通信であると判断する。

【0047】ここで、図6は、配信管理テーブルの一例を示す図である。図6において、項目D11～D16は、管理単位が同じ通信に関する情報を表す項目であり、項目D17～D19は、管理単位が同じ通信においてデータ配信管理装置10が受信したデータバケットに関する情報を表す項目である。各項目D11～D19は、データ配信管理装置10が受信したデータバケットから取得された情報である。項目D11は、管理する通信の送信元IPアドレスを表し、項目D12は、宛先IPアドレスを表し、項目D13は、送信元ポート番号を表し、項目D14は、宛先ポート番号を表し、項目D15は、仮ACK停止フラグを示し、項目D16は、送信元および宛先におけるそれぞれの最新の送信ウィンドウサイズおよび受信ウィンドウサイズを表している。また、項目D17は、この通信においてデータ配信管理装置10が受信したデータセグメントのシーケンス番号を表し、項目D18は、tmpACKの送信に関する情報を表している。この項目D18の情報は、送信元に対して一定の条件が整った時などの条件付の場合を含め、送信可能なデータバケットであるか否かの情報およびtmpACKを送信したか否かの情報などを値として用いるものである。また、項目D19は、宛先からの送達確認応答（RRACK）に対する情報を表すものであり、図6では、対応するデータバケットがRRACKを受信済であることを表す「ACK受信済」およびRRACKの到達を待っている状態であることを表す「ACK待ち」の2つの値をもつ。

【0048】たとえば、図6において、行DD1には、送信元の端末装置「10.74.3.177」の送信ポート「FTP.DATA」から、宛先の端末装置「10.74.3.200」の宛先ポート「1301」に対する通信において、仮ACK停止フラグが「OFF」であり、送信元の送信ウィンドウサイズおよび受信ウィンドウサイズ、および宛先の送信ウィンドウサイズおよび受信ウィンドウサイズは全て16Kバイト

であり、シーケンス番号「398」を持つデータバケットは、tmpACKの送信が「不可」、すなわち、いかなる条件になった場合でも、tmpACKの送信を行わないデータバケットであり、現時点で宛先からの送達確認応答を待っている状態であることを表すものである。

【0049】SG配信管理部16は、この配信管理テーブル1の上述した項目および必要に応じて追加する項目を用いて、データバケットのtmpACKの管理、受信確認、および受信結果に応じた再送の制御、送信元へのtmpACKおよび宛先からの送達確認応答であるRRACKの送信速度の制御、宛先への転送速度の制御、データ配信管理装置10の送信バッファ6および受信バッファ7の管理を行うことができる。

【0050】データ配信管理装置10は、この配信管理テーブル1を用いて、受信したデータバケットのIPヘッダにある送信元IPアドレスおよび宛先IPアドレス、およびTCPヘッダにある送信元ポート番号および宛先ポート番号を参照し、IPヘッダ中の送信元IPとTCPヘッダ中の送信元ポートとの組み合わせ、および宛先IPと宛先ポートとの組み合わせで表される通信が、配信管理テーブル1内にあるか否かの判断を行う。この判断の結果、配信管理テーブル1に登録されていない通信であった場合（ステップS27、NO）、ステップS22に移行することになる。

【0051】また、配信管理テーブル1に登録されている通信であると判断された場合（ステップS27、YES）、ステップS31に移行し、受信したデータバケットが、宛先の受信ウィンドウ内のデータバケットであるか否かを判断し、宛先の受信ウィンドウ内のデータバケットであった場合（ステップS31、YES）、ステップS32に移行し、宛先の受信ウィンドウ内のデータバケットでなかった場合（ステップS31、NO）、tmpACK利用可能フラグを「OFF」にし、配信管理テーブル1に、データバケットに関する情報を登録し、tmpACK利用可能フラグを「OFF」に設定し（ステップS39）、受信したデータバケットを宛先に転送し（ステップS23）、ステップS11にリターンする。

【0052】一方、ステップS32において、通信終了のデータバケットでないと判断された場合、ステップS34に移行する。ステップS34において、配信管理テーブル1を参照し、送信元の「送信Windowサイズ」が規定のWindowサイズ、たとえば「2」以上に達しているか否か、および宛先の「受信Windowサイズ」が規定のWindowサイズ、たとえば「2」以上に達しているか否かを判断し、双方ともに規定のWindowサイズに達していると判断した場合（ステップS34、YES）、データ配信管理装置10のtmpACK利用可能フラグを「OFF」に設定し（ステップS39）、受信したデータバケットを宛先に転送し（ステップS23）、ステップS11にリターンする。ま

た、ステップS32において、通信終了のデータバケットであると判断された場合（ステップS32、YES）には、ステップS40に移行する。ステップS40では、図6に示した配信管理テーブルのtmpACK送信に関する項目D18に、「不可」かつ「FINフラグ受信済み」を入れ、ステップS23に移行する。

【0053】一方、ステップS34において、Windowサイズが十分でないと判断された場合、受信したデータバケットが端末装置C2からの送達確認応答であるか否かを判断する（ステップS35）。受信したデータバケットが端末装置C2からの送達確認応答でないと判断された場合（ステップS35、NO）、配信管理テーブル1に、情報を登録し、tmpACK利用可能フラグを「ON」に設定し（ステップS37）、受信したデータバケットを宛先に転送し（ステップS23）、ステップS11にリターンする。なお、tmpACK利用可能フラグを「ON」にしたデータバケットは、送信バッファ6に保存する。ステップS37の処理を行う際、実装によっては、最新のデータバケットの到着時点における情報として、配信管理テーブル1の個々のデータバケットに関する情報のエントリ毎にtmpACKの利用が可能か否かの情報を設定する。これによって、たとえばスロースタート時にはtmpACK利用制御を行わない、などのウィンドウサイズの状態に応じた細かな制御を行うことができる。

【0054】受信したデータバケットが端末装置C2からの送達確認応答であると判断された場合（ステップS35、YES）、tmpACKバッファ4に、受信したデータバケットを保存し、データ配信管理装置10のSG配信管理部16に対して、端末装置C2から送達確認応答を受信したことを通知するイベントを発生させ、tmpACK利用可能フラグを「ON」に設定し（ステップS36）、ステップS11にリターンする。なお、このステップS36の処理は、実装によって、たとえば、IPヘッダおよびIPデータ部のみなどの必要な部分のみを保存することも可能である。また、シーケンス番号などによって、受信したデータバケットが既にtmpACK作成用のデータバケットとして登録されていたものより、後のデータバケットであるか否かを判断し、最新すなわち最も後のデータバケットをtmpACK作成用のデータバケットとして登録するようにしてもよい。また、ステップS35において、受信したデータバケットが端末装置C2からの送達確認応答ではなかった場合（ステップS35、NO）も、tmpACK作成用として、tmpACKバッファ4に、受信したデータバケットを保存し、tmpACK作成時にそのデータを利用することも可能である。

【0055】一方、ステップS26において、通信開始のデータバケットであると判断された場合、現在判断を行っているデータバケットを含めて、通信開始のデータ

バケットが通信の手順通りに正しく送受信されているか否かの判断を行う（ステップS29）。一連の作業によって、通信開始のデータバケットは正しい順序で到達されたことを確認されたもののみ、図示しない開始時バケットバッファに保存される。従って、このステップS29の判断は、受信したデータバケットが、最初の通信開始時用のデータバケットであるか、あるいは同一通信における最後に受信された通信開始時用のデータバケットの次に受信されるべきデータバケットであるのかのいずれかをチェックすればよいことになる。

【0056】その後、データ配信管理装置10が正しい順序で通信開始のデータバケットを受信していると判断された場合（ステップS29、YES）、このデータバケットの情報を配信管理テーブル1に追加登録する（ステップS30）。その後、受信したデータバケットが端末装置C2からの送達確認応答であるか否かを判断し（ステップS41）、端末装置C2からの送達確認応答であると判断された場合（ステップS41、YES）、上述したステップS36の処理を行った後、ステップS11にリターンする。一方、端末装置C2からの送達確認応答でないと判断された場合（ステップS41、NO）、受信したデータバケットを宛先に転送し（ステップS23）、ステップS11にリターンする。

【0057】一方、ステップS29において、データ配信管理装置10が正しい順序で通信開始のデータバケットを受信していないと判断された場合（ステップS29、NO）およびステップS27において配信管理テーブル1に登録されている通信でないと判断された場合（ステップS27、NO）、データ配信管理装置10のtmpACK利用可能フラグを「OFF」にし（ステップS22）、受信したデータバケットを宛先に転送し（ステップS23）、ステップS11にリターンする。

【0058】つぎに、図7に示すフローチャートを参照して、図2に示したステップS13によるtmpACK利用制御処理の詳細手順について説明する。図7は、ウィンドウサイズに応じたtmpACKの送信タイミングの調整処理手順を示すフローチャートである。ここで、この調整処理は、データセグメントが受信され、tmpACK利用制御フラグを参照し、tmpACK利用制御実施イベント、あるいは遅延仮ACKに関わるタイマやカウンタから出力されるイベントによって開始される。遅延仮ACKは、TCPにおける遅延ACKの手法などと同様に、一定時間あるいは一定バケット数の受信を待ってから仮ACK(tmpACK)を作成および送信することで、データ配信管理装置10の処理およびデータ配信管理装置10との間のフローの削減を促すことを目的とする。

【0059】したがって、遅延仮ACKに関わるタイマやカウンタが出力するイベントとは、たとえば、一定時間待ってから遅延仮ACKの作成および送信を行う方法

による遅延仮ACKを用いる実装の場合、tmpACK使用判定部12が、遅延仮ACKを発生させるタイミングをはかるタイマ、タイムアウト時間変数あるいは定数およびそれらによってオン、オフの値が設定される遅延仮ACK時間経過フラグを持ち、一定時間毎にtmpACK作成部13に対して、遅延仮ACK用の待ち時間がきたことを知らせるために発生するものである。

【0060】図7において、まず図3に示した一連の処理によって設定されたFIN受信済フラグの値を参照し、通信終了のデータパケットが受信済であるか否かの判断を行う(ステップS51)。FINパケット受信済と判断された場合(ステップS51、YES)、そのままステップS13にリターンする。一方、FINパケット受信済と判断されなかった場合(ステップS51、NO)、tmpACKバッファ4に保存してあるデータパケットがSYNデータパケットとACKデータパケット((SYN+ACK)パケット)であるか否かを判断する(ステップS52)。(SYN+ACK)パケットであった場合(ステップS52、YES)、未転送の(SYN+ACK)パケットを送信元、すなわち端末装置C1に転送し(ステップS53)、ステップS13にリターンする。一方、ステップS52において、tmpACKバッファ4に保存してあるデータパケットが(SYN+ACK)パケットでないと判断された場合(ステップS52、NO)、配信管理テーブル1および後述する図6に示す仮ACK作成停止フラグの「ON」、「OFF」を参照し、tmpACKの送信に必要なデータセグメントを受信しているか否かおよび仮ACK送信可能か否かの判断を行う(ステップS54)。tmpACKの送信に必要なデータセグメントを受信したか否かの判断は、たとえばtmpACKを作成しようとしているセグメントXから、後のシーケンス番号のセグメントが1つ以上受信した時点で、セグメントXに対するtmpACKの作成を可能とするという実装とすることができる。

【0061】ステップS54において、tmpACKの送信に必要なデータセグメントを受信していないと判断した場合(ステップS54、NO)、tmpACKバッ\*

$$Wtime_{e,e} = \text{Min} [\text{UBOUND}, \text{Max} [Wtime_{e,e} - (\text{WindowSIZE}_{e,e} - \text{WindowSIZE}_{e,o}) * \alpha, \text{LBOUND}]]$$

である。ここで、「 $Wtime_{e,e}$ 」は、現在の待ち時間であり、「LBOUND」は、送信待ちの上限値であり、たとえば端末装置C1における再送タイムアウト値などに設定される。また、「 $Wtime_{e,o}$ 」は、前回算出した「 $Wtime_{e,e}$ 」であり、初期値は、「LBOUND」である。「 $WindowSIZE_{e,e}$ 」は、現在の端末装置C1のウィンドウサイズであり、「 $WindowSIZE_{e,o}$ 」は、前回の端末装置C1のウィンドウサイズである。「LBOUND」は、送信待ちの下限值、たとえば「0」であり、「 $\alpha$ 」は、「 $Wtime_{e,e}$ 」を算出するための所定数を表

\*ファ4にある未転送のACKセグメントが存在する場合、このACKセグメントを端末装置C1に転送し(ステップS53)、ステップS13にリターンする。

【0062】一方、ステップS54において、tmpACKの送信に必要なデータセグメントを受信したと判断した場合(ステップS54、YES)、tmpACKの作成の対象となる端末装置C1からのデータセグメントを決定する(ステップS55)。このステップS55の処理では、配信管理テーブル1を用い、端末装置C1のウィンドウ(Window)サイズ、tmpACKの送信状況および端末装置C1、C2間のTCPプロトコルのSACKオプションなどを参照して処理を行う。

【0063】たとえば、SACKオプションなしの通信の場合、配信管理テーブル1のエントリのうち、ACK受信待ちであり、かつ、tmpACKを送信しておらず、かつ自シーケンス番号に比してシーケンス番号が小さいセグメントが全てデータ配信管理装置10において受信されているセグメントの中で、シーケンス番号が2番目に大きいものを、tmpACK作成の対象として決定する。

【0064】その後、tmpACK作成バッファに保存してあるセグメントの確認応答番号を、ステップS55によって決定したtmpACK作成対象セグメントのシーケンス番号に「1」を加えた番号に書き換えたセグメントを、tmpACKとして作成する(ステップS56)。SACKオプション付きのTCPの場合、ステップS55において、SACKオプションを考慮したtmpACK作成対象を決定し、ステップS56において、SACKオプションも加えた送達確認応答を作成する実装を行うことも可能である。

【0065】その後、送信元である端末装置C1に対してtmpACKを送信する(ステップS57)。ここで、ウィンドウサイズに応じ、送信タイミングを加減する。たとえば、次式(1)に示す待ち時間 $Wtime_{e,e}$ 待った後に、tmpACKの送信を行うようにする。すなわち、

$$\dots (1)$$

す。

【0066】tmpACKを送信元に転送した後、送信したtmpACKに対応する全ての配信管理テーブル1上にエントリしてあるセグメントの情報をtmpACK送信済みを設定変更し(ステップS58)、ステップS13にリターンする。

【0067】つぎに、図8に示すフローチャートを参照して、データ配信管理装置10のSG配信管理部16による受信確認処理およびその結果による再送制御処理の

50 手順について説明する。この受信確認処理および再送制

御処理は、図2に示したパケットのチェック処理および tmpACK 利用制御処理と並列して処理される。

【0068】図8において、まず端末装置C2からの送達確認応答の到着を示すイベントを受け取ったか否かを判断する(ステップS61)。このイベントは、ステップS11におけるパケットのチェックの処理において発生されるイベントである。送達確認応答が到着していた場合(ステップS61、YES)、端末装置C2からの開始通知であるか否かを判断し(ステップS69)、開始通知であった場合(ステップS69、YES)、本処理を終了する。一方、端末装置C2からの開始通知でないと判断された場合(ステップS69、NO)、配信管理テーブル1に、受信した送達確認応答が示すデータセグメントに対する結果を記入する(ステップS70)。たとえば、SACKオプションなしの通信の場合、配信管理テーブル1のエントリのうち、ACK受信待ちであり、かつ、受信した送達確認応答が示すデータセグメントに比してシーケンス番号が小さいデータセグメントの全てをACK受信済にする。一方、SACKオプションありの通信の場合、配信管理テーブル1のエントリのうち、ACK受信待ちであり、かつ、受信した送達確認応答が示すデータセグメントに比してシーケンス番号が小さいデータセグメントであり、かつ、SACKオプションにないデータセグメントの全てをACK受信済とする。

【0069】ステップS70の処理後、配信管理テーブル1のエントリのうち、ACK受信済のセグメントを送信バッファ6から削除する(ステップS71)。ここで、ACK受信セグメントの削除処理は、削除に関するタイマを持ち、一定時間毎にまとめて削除するようにしてもよい。

【0070】一方、ステップS61において、端末装置C2からの送達確認応答受信のイベントを受けていないと判断された場合、さらに再送タイムアウトが発生した\*

$$X - y < m + k$$

である。

【0073】その後、配信管理テーブル1にあるタイムアウトが発生したデータセグメントのエントリの再送回数をインクリメントし、再送フラグを「ON」にし(ステップS66)、配信終了か否かの判断を行う(ステップS67)。通常のTCP通信における配信終了のデータパケットの交換を検知した場合、あるいは再送のタイムアウトを繰り返して、データ配信管理装置10が再送のリトライアウトをすることによって配信を終了する場合に、配信終了と判断され(ステップS67、YES)、配信終了処理を行い(ステップS68)、本処理を終了する。なお、再送のタイムアウト値、およびリトライアウトの回数は、端末装置C1および端末装置C2における再送のタイムアウト値およびリトライアウト回数よりも十分に長く設定される必要がある。

\* 可否かを判断する(ステップS62)。再送タイムアウトが発生していなかった場合(ステップS62、NO)、そのまま本処理を終了する。一方、再送タイムアウトが発生したと判断された場合(ステップS62、YES)、tmpACKの送信を停止するか否かを判断する(ステップS63)。

【0071】ここで、データ配信管理装置10は、受信バッファ7にあわせた擬似ウィンドウ(TCP通信におけるウィンドウを模倣したもの)を持ち、この擬似ウィンドウサイズから、受信バッファ7に残っている分量を減算した量、すなわち擬似ウィンドウサイズから、送信元から受信したセグメントの総量を減算し、さらに宛先からの送達確認応答がきているセグメントの総量を加算した量が、データ配信管理装置10において把握している送信元のウィンドウサイズよりもさらに1セグメント分のサイズを越える場合、tmpACKの停止をしないと判断し(ステップS63、NO)、図6に示した仮ACK作成停止フラグを「OFF」に設定し、tmpACKの送信を開始する処理を行い(ステップS64)、ステップS66に移行する。

【0072】一方、その逆である場合、tmpACKの停止をすると判断し(ステップS63、YES)、図6に示した仮ACK作成停止フラグを「ON」に設定し、tmpACKの送信を停止する処理を行い(ステップS65)、ステップS66に移行する。ここで、上述したtmpACKを停止するか否かの判断を具体的に説明する。擬似ウィンドウサイズを「X」バイト、この時点におけるデータ配信管理装置10が把握している送信元すなわち端末装置C1のウィンドウサイズを「m」バイト、現在受信バッファ7にあるセグメントの総量を「y」バイト、受信する1セグメントの大きさを「k」バイトとすると、次式(2)が成立したときに、仮ACKの停止をする判断を行う。すなわち、

$$\dots (2)$$

【0074】ステップS68の処理は、配信終了状態によって異なる処理を行う。通常のTCP通信における配信終了のデータパケットの交換を検知した場合、tmpACKバッファ4、送信バッファ6、受信バッファ7の全てにおいて、終了する通信におけるデータセグメントを全て削除し、配信管理テーブル1のエントリも削除する。なお、配信管理テーブル1のエントリは、データの蓄積を兼ね、保存しておくことも可能である。また、エントリに寿命を設け、あるいはエントリが溢れない限り残しておくようにしてもよい。

【0075】一方、ステップS67において、配信終了でないと判断された場合、ステップS72～S74の再送処理を行う。すなわち、ステップS72では、配信管理テーブル1の再送フラグが「ON」になっているものを、送信バッファ6のデータセグメントを再送し、配信

管理テーブル1の再送フラグを「OFF」にする。このステップS72の処理後、再送タイマをリセットし（ステップS73）、データ配信管理装置10の再送回数カウンタのインクリメントを行い（ステップS74）、本処理を終了する。

【0076】実施の形態2. つぎに、この発明の実施の形態2について説明する。この実施の形態2では、図6に示したtmpACK利用制御処理を、ウィンドウサイズに応じた遅延を付加してtmpACKの作成処理および送信処理を行うようにしている。

【0077】図9は、この発明の実施の形態2であるデータ配信管理装置のtmpACK利用処理手順を示すフローチャートである。図9において、図2に示した一連の処理によって設定されたFIN受信済フラグの値を参照し、通信終了のデータバケットが受信済であるか否かの判断を行う（ステップS81）。FINバケット受信済と判断された場合（ステップS81、YES）、そのままステップS13にリターンする。

【0078】一方、FINバケット受信済と判断されなかった場合（ステップS81、NO）、仮ACK用の遅延時間が経過したことを示すフラグが立っているか否かを判断する（ステップS82）。仮ACK用の遅延時間が経過していた場合（ステップS82、YES）、遅延仮ACKタイマおよび関連フラグをリセットする（ステップS83）。

【0079】このとき、たとえば、図10に示す対応テーブルを用い、ウィンドウサイズに応じた遅延仮ACKタイマ値を更新設定する。たとえば、図10において、ウィンドウサイズが「5」kbyte以上である場合には、遅延タイマを「5」msecに更新設定する。その後、ステップS84に移行する。

【0080】ステップS82において、仮ACK用の遅延時間が経過していないと判断された場合、データ配信管理装置10において、端末装置C1に対する未転送データがあるか否かを判断し（ステップS86）、未転送データがなかった場合（ステップS86、NO）は、ステップS13にリターンし、未転送データがあった場合（ステップS86、YES）、ステップS87に移行する。

【0081】ステップS87において、tmpACKバッファ4に保存してあるデータバケットが（SYN+ACK）バケットであるか否かを判断し、（SYN+ACK）バケットであった場合、未転送の（SYN+ACK）バケットを宛先に転送し（ステップS85）、ステップS13にリターンする。

【0082】一方、ステップS87において、tmpACKバッファ4に保存してあるデータバケットが（SYN+ACK）バケットでないと判断された場合、tmpACKの送信に必要なデータセグメントを受信しているか否かの判断を行う（ステップS88）。ステップS

4およびステップ88の処理では、配信管理テーブル1および仮ACK作成フラグのオン、オフを参照し、tmpACKの送信に必要なセグメントを受信したか否かおよびtmpACKの送信が可能か否かを判断する。すなわち、遅延ありtmpACKを使用するか否かを判断する。tmpACK送信に必要なセグメントを受信したか否かの判断は、たとえば、tmpACKを作成しようとしているセグメントXよりも、後のシーケンス番号のセグメントを1つ以上受信した時点で、セグメントXに対するtmpACKの作成が可能とする。

【0083】ステップS84において、遅延ありtmpACKを使用しないと判断した場合、tmpACKバッファ4にある未転送のACKバケットを端末装置C1に転送し（ステップS85）、ステップS13にリターンする。

【0084】一方、ステップS84、S88において、遅延ありtmpACKを使用すると判断した場合、tmpACKの作成の対象となる端末装置C1からのデータセグメントを決定する（ステップS89）。このステップ89の処理では、配信管理テーブル1を用い、データ配信管理装置10における受信状況、送信元のウィンドウサイズ、tmpACKの送信状況、および端末装置C1と端末装置C2との間のTCPプロトコルのSACKオプションなどを参照して処理を行う。

【0085】たとえば、SACKオプションなしの通信の場合、配信管理テーブル1のエントリのうち、ACK受信待ちであり、かつ、tmpACKを送信しておらず、かつ、自シーケンス番号に比してシーケンス番号が小さいセグメントが全てのデータ配信管理装置10において受信されているセグメントの中で、シーケンス番号が、2番目に大きいものを、tmpACK作成対象として決定する。

【0086】また、たとえば、SACKオプションありの通信の場合、tmpACK送信可能であり、かつ、tmpACK未送信であり、かつ、ACK受信待ちであり、かつ、自シーケンス番号が小さいセグメントのうち、連続したシーケンス番号を持つ未受信のセグメント群が4つ以下であるデータ配信管理装置10において受信しているセグメントのなかで、シーケンス番号が最も後ろのものよりも一つ前のセグメントをtmpACKの作成および送信の対象として決定する。

【0087】ステップS89の処理後、tmpACKバッファ4に保存してあるデータセグメントの到達確認応答番号を、ステップS89において決定したtmpACKの作成対象のデータセグメントのシーケンス番号に「1」を加えた番号に書き換えたデータセグメントを、tmpACKとして作成する。SACKオプション付のTCPの場合、ステップS89においてSACKオプションを考慮したtmpACKを作成する実装も可能である。その後、ステップS90において、SACKオブシ

ョンも加えた送達確認応答を作成する。

【0088】ステップS90の処理後、端末装置C1にtmpACKを送信し（ステップS91）、この送信したtmpACKが対応する全ての配信管理テーブル1上にエントリしてあるデータセグメントの情報をtmpACK送信済に変更設定し（ステップS92）、ステップS13にリターンする。

【0089】

【発明の効果】以上説明したように、この発明によれば、保持手段が、前記第1の端末装置のウィンドウサイズの情報を保持し、決定手段が、前記保持手段が保持するウィンドウサイズの情報をもとに前記送達確認応答の返送処理を行うか否かを決定し、制御手段が、前記決定手段が前記送達確認応答の返送処理を行うと決定した場合のみに前記送達確認応答の返送処理を行うようにし、送信元に対する送達確認応答の送信タイミングあるいは送信量を調整するようにしているので、一層高速かつ効率的にデータ配信を行うことができるとともに、送信元の状況に見合わない急激なデータ送信速度あるいはデータ量の増加を回避することができるデータ配信管理装置を実現することができるという効果を奏する。

【0090】つぎの発明によれば、保持手段が、前記第1の端末装置のウィンドウサイズの情報を保持し、制御手段が、前記保持手段が保持するウィンドウサイズの情報が示すウィンドウサイズに応じて前記第1の端末装置が送信したデータに対する前記送達確認応答の返送タイミングを可変させる制御を行うようにしているので、一層高速かつ効率的にデータ配信を行うことができるデータ配信管理装置を実現することができるという効果を奏する。

【0091】つぎの発明によれば、算出手段が、前記第2の端末装置から受信した送達確認応答の受信時点から前記第1の端末装置に送達確認応答を返送する返送時点までの遅延時間に略対応した所定の下限値を初期値とする現在の遅延時間から、前記第1の端末装置における現在のウィンドウサイズから前回のウィンドウサイズを減算した第1の減算値に所定値を乗算した第2の値を減算した第2の減算値と、前記所定の下限値との最大値を算出し、該最大値と所定の上限値との最小値とを算出し、該最小値を前記現在の遅延時間として再設定する処理を繰り返して最新の現在の遅延時間を算出し、前記制御手段が、前記算出手段によって算出された最新の現在の遅延時間に応じて前記第1の端末装置が送信したデータに対する前記送達確認応答の返送タイミングを可変させる制御を行うようにしているので、一層高速かつ効率的にデータ配信を行うことができるデータ配信管理装置を実現することができるという効果を奏する。

【0092】つぎの発明によれば、保持手段が、前記第1の端末装置のウィンドウサイズと前記第1の端末装置から受信したデータのセグメント数と前記第2の端末装

置からの受信確認応答の有無とを少なくとも保持し、決定手段が、前記保持手段が保持する前記ウィンドウサイズと前記セグメント数と前記受信確認応答の有無との組み合わせによって前記第1の端末装置が送信したデータに対する前記送達確認応答の返送を行うか否かを決定し、制御手段が、前記決定手段が前記送達確認応答の返送を行うと決定した場合に該送達確認応答の返送を行うようにしているので、一層高速かつ効率的にデータ配信を行うことができるデータ配信管理装置を実現することができるという効果を奏する。

【0093】つぎの発明によれば、保持手段が、前記第1の端末装置のウィンドウサイズの情報を保持し、制御手段が、前記保持手段が保持するウィンドウサイズの情報が示すウィンドウサイズに応じて前記第1の端末装置が送信したデータに対する前記送達確認応答の作成密度を可変、たとえば送達確認応答を間引く制御を行うようにしているので、一層高速かつ効率的にデータ配信を行うことができるデータ配信管理装置を実現することができるという効果を奏する。

【0094】つぎの発明によれば、データバッファが、少なくとも前記第1の端末装置が送信したデータを保持し、管理手段が、少なくとも前記第1の端末装置が送信したデータの登録情報を管理し、削除制御手段が、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答を受信した場合、前記データバッファに保持されている該データおよび前記管理手段が管理する該データの登録情報を削除する制御を行うようにしているので、データ配信管理装置にかかる負荷を軽減することができるという効果を奏する。

【0095】つぎの発明によれば、計数手段が、前記データバッファ内に保持されたデータのうちの削除対象のデータである送達確認済みのセグメント数を計数し、前記削除制御手段が、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに登録情報を送達確認済みに設定し、前記計数手段が計数する該送達確認済みに設定されたセグメント数が所定数を越えた場合に、前記データバッファに保持されている該送達確認済みのデータと前記管理手段が管理する該送達確認済みのデータの登録情報を削除するようにしているので、データ配信管理装置にかかる負荷を軽減することができるという効果を奏する。

【0096】つぎの発明によれば、第1の計数手段が、前記データバッファ内に保持されたデータのうちの削除対象のデータである送達確認済みのセグメント数を計数し、第2の計数手段が、前記管理手段が管理するデータのうちの削除対象のデータの登録情報を計数し、前記削除制御手段が、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達

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確認応答の受信の都度、前記管理手段が管理する該データに関する情報を送達確認済みに設定し、前記第1の計数手段が計数する送達確認済みに設定されたセグメント数が第1の所定数を越えた場合に、前記データバッファに保持されている該送達確認済みのデータを削除し、前記第2の計数手段が計数する送達確認済みのデータの登録情報が第2の所定数を越えた場合に、該送達確認済みのデータの登録情報を削除するようにしているので、データ配信管理装置にかかる負荷を軽減することができるという効果を奏する。

【0097】つぎの発明によれば、計時手段が、所定時間を計時する計時手段をさらに備え、前記削除制御手段が、前記第1の端末装置が送信したデータを転送した前記第2の端末装置から該データに対する送達確認応答の受信の都度、前記管理手段が管理する該データに登録情報を送達確認済みに設定し、計時手段が前記所定時間を計時した際に、前記データバッファに保持されている該送達確認済みのデータと前記管理手段が管理する該送達確認済みのデータの登録情報を削除するようにしているので、データ配信管理装置にかかる負荷を軽減することができるという効果を奏する。

【図面の簡単な説明】

【図1】 この発明の実施の形態1であるデータ配信管理装置を含むデータ配信管理システムの構成を示すブロック図である。

【図2】 図1に示したデータ配信管理装置によるデータ配信管理処理手順を示すフローチャートである。

【図3】 図2に示したバケットのチェック処理手順を示す詳細フローチャートである。

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\*【図4】 図1に示した経路管理テーブルの内容の一例を示す図である。

【図5】 図1に示したプロトコル管理テーブルの内容の一例を示す図である。

【図6】 図1に示した配信管理テーブルの内容の一例を示す図である。

【図7】 図2に示したtmpACK利用制御処理手順を示す詳細フローチャートである。

【図8】 図1に示したデータ配信管理装置による受信確認処理および再送制御処理の手順を示すフローチャートである。

【図9】 この発明の実施の形態2であるデータ配信管理装置によるtmpACK利用制御処理手順を示す詳細フローチャートである。

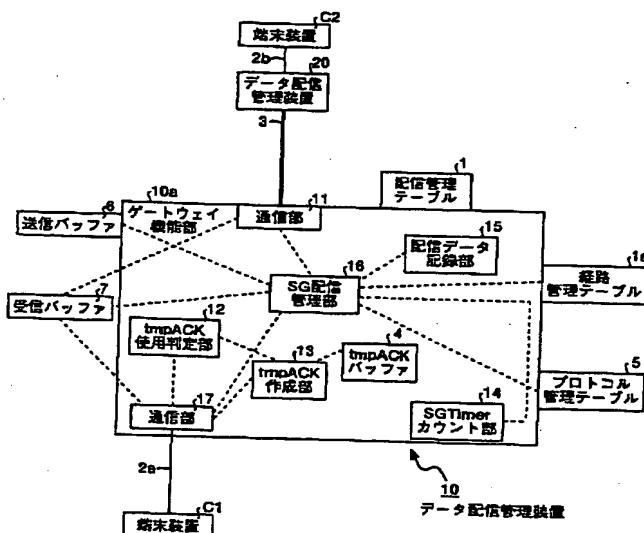
【図10】 図9に示したデータ配信管理装置が有するウィンドウサイズと遅延タイマの設定値との対応関係を示す対応テーブルの一例を示す図である。

【図11】 従来のデータ配信管理装置を含むデータ配信管理システムの構成を示すブロック図である。

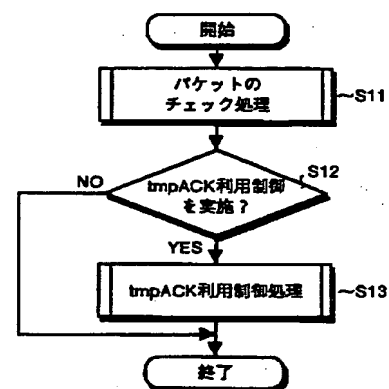
【符号の説明】

1 配信管理テーブル、1a 経路管理テーブル、2 a, 2b, 3 回線、4 tmpACKバッファ、5 プロトコル管理テーブル、6 送信バッファ、7 受信バッファ、10, 20 データ配信管理装置、10a ゲートウェイ機能部、11, 17 通信部、12 tmpACK使用判定部、13 tmpACK作成部、14 SGTimerカウント部、15 配信データ記録部、16 SG配信管理部、C1, C2 端末装置。

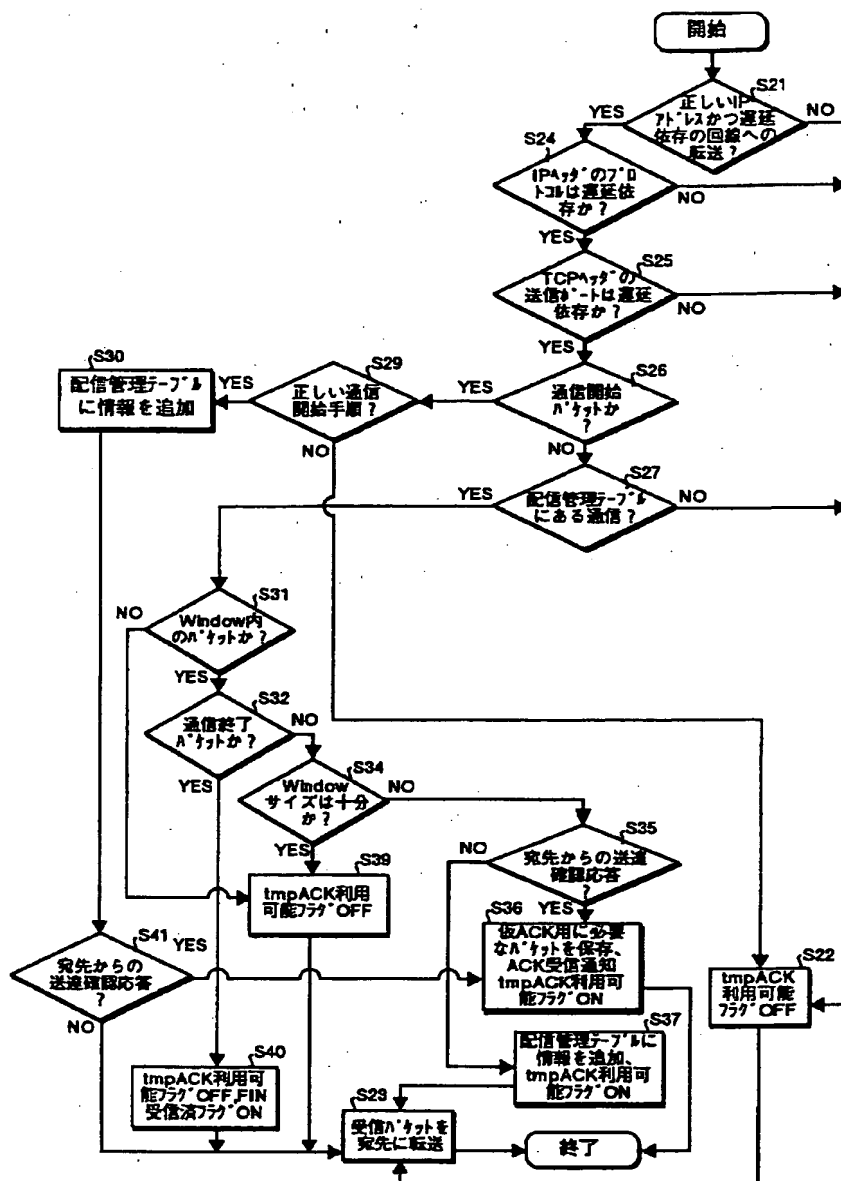
【図1】



【図2】



【圖3】



【図4】

経路		宛先 IP	Window サイズ	
ポート	遅延有無		送	受
経路1	○	10.74.3. 200	宛先	16 K
経路2	×			16 K
経路3	×			16 K
経路4	×			16 K
経路1	○	10.85.6. 172	宛先	16 K
経路3	×			16 K

【圖 10】

Window サイズ	遅延タイム
0~1	0
2~4	5msec
5以上	6msec

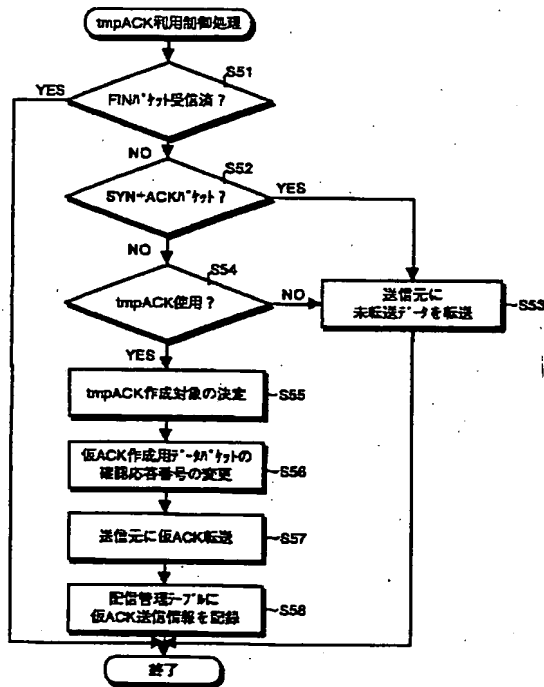
【圖5】

	D1	D2	D3
参照ヘッダ	プロトコル名	スプーフィング使用可否	
IP	TCP	○	
	UDP	×	
	ICMP	×	
TCP	BGP	×	

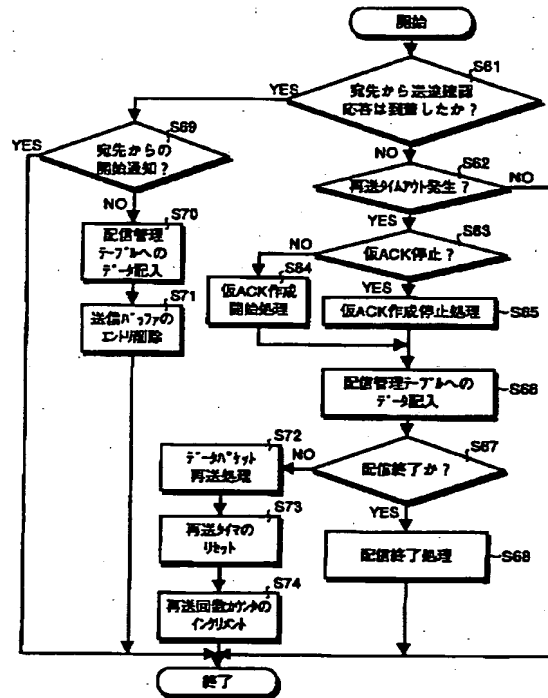
【圖 6】

D11	D12	D13	D14	D15	D16	D17	D18	D19		
送信元IP	宛先IP	送信元ポート	宛先ポート	WACK 停止???	Window F1?	Packet Num	ImpACK送信	RRACK状態		
10.74.3.177	10.74.3.200	FTP.DATA	1301	OFF	送信元	送 16K	399 不可	ACK待ち	D01	
						受 399	満	ACK受信済		
					宛先	受 16K	・	満		ACK待ち
						・	満	ACK待ち		
						送 16K	・	満		ACK待ち
						受 16K	・	満		ACK待ち
	送 16K	・	満	ACK待ち						
	受 16K	k	可能	ACK待ち						

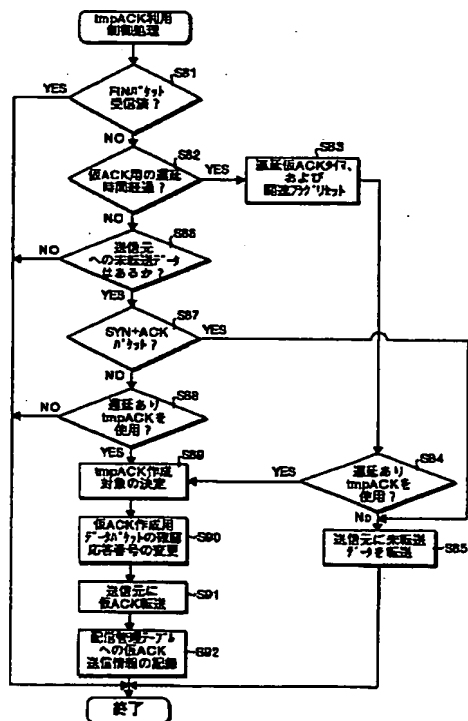
【図7】



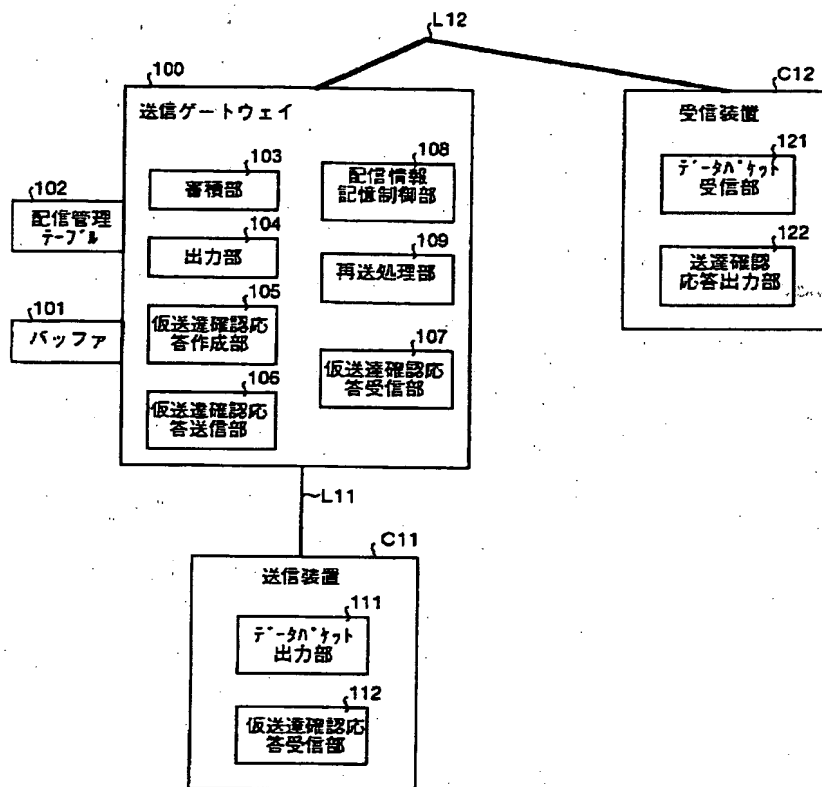
【図8】



【図9】



【図11】



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